SABER

DC 3306

DC 3306
DC 3306
DC 3306

Installation • Operation • Maintenance

DC Drives

Technical Manual
TM 3260

MagneTek
Drives & Systems

SERVICE NOTE

06 APR 90

Subject: **GROUNDING**

IMPORTANT

The following information supersedes the grounding information contained in any Controller manual with which this Service Note is provided.

GENERAL

For your convenience in grounding the Controller, Operator's Control Station or motor, ground studs are located and marked within the Controller. The ground connection can be made using any high quality, commercially available terminal.

CSA AND/OR U.L. INSTALLATIONS

These organizations require that ground terminations be made via properly sized, certified/listed terminals. Terminal kits suitable for these installations can be obtained through your local MagneTek sales representative. Refer to the appropriate Ground Kit part number listed below when entering an order.

Mod7 Eddy Current Controller 46S02547-0010

Saber 3306 Controller

5HP thru 50HP, 230 VAC 46S02547-0020
60HP, 75HP, 230 VAC 46S02547-0030

7.5HP thru 100HP, 460 VAC 46S02547-0020
125HP thru 200HP, 460 VAC 46S02547-0030

Lancer I Controller (VFD)

40HP thru 75HP 46S02547-0020
100HP thru 200HP 46S02547-0030
250HP thru 600HP 46S02547-0070

TABLE OF CONTENTS

CAUTION

NEVER CONNECT CAPACITORS ACROSS THE CONTROLLER OUTPUT AND MOTOR. UPON APPLICATION OF POWER, THE CONTROLLER INITIALLY SEES THE CAPACITORS AS A SHORT CIRCUIT, HIGH CURRENTS RESULT AND EQUIPMENT WILL BE DAMAGED.

IF REQUIRED, POWER FACTOR CORRECTION CAPACITOR NETWORKS MAY BE CONNECTED ACROSS THE INPUT POWER SOURCE ONLY AFTER CONSULTING MAGNETEK.

IMPROPER USE OF POWER FACTOR CORRECTION CAPACITOR NETWORKS WILL DAMAGE EQUIPMENT.

SECTION 1. INTRODUCTION

1.1 GENERAL

This manual provides information which covers the entire horsepower range the SABER 3306 Controller may be operated in. The manual contains paragraphs and/or adjustment procedures which are not applicable throughout the entire horsepower range. Such paragraphs/adjustment procedures are identified as to the horsepower range to which they pertain. If no horsepower range is identified, the information is applicable to all Controller applications.

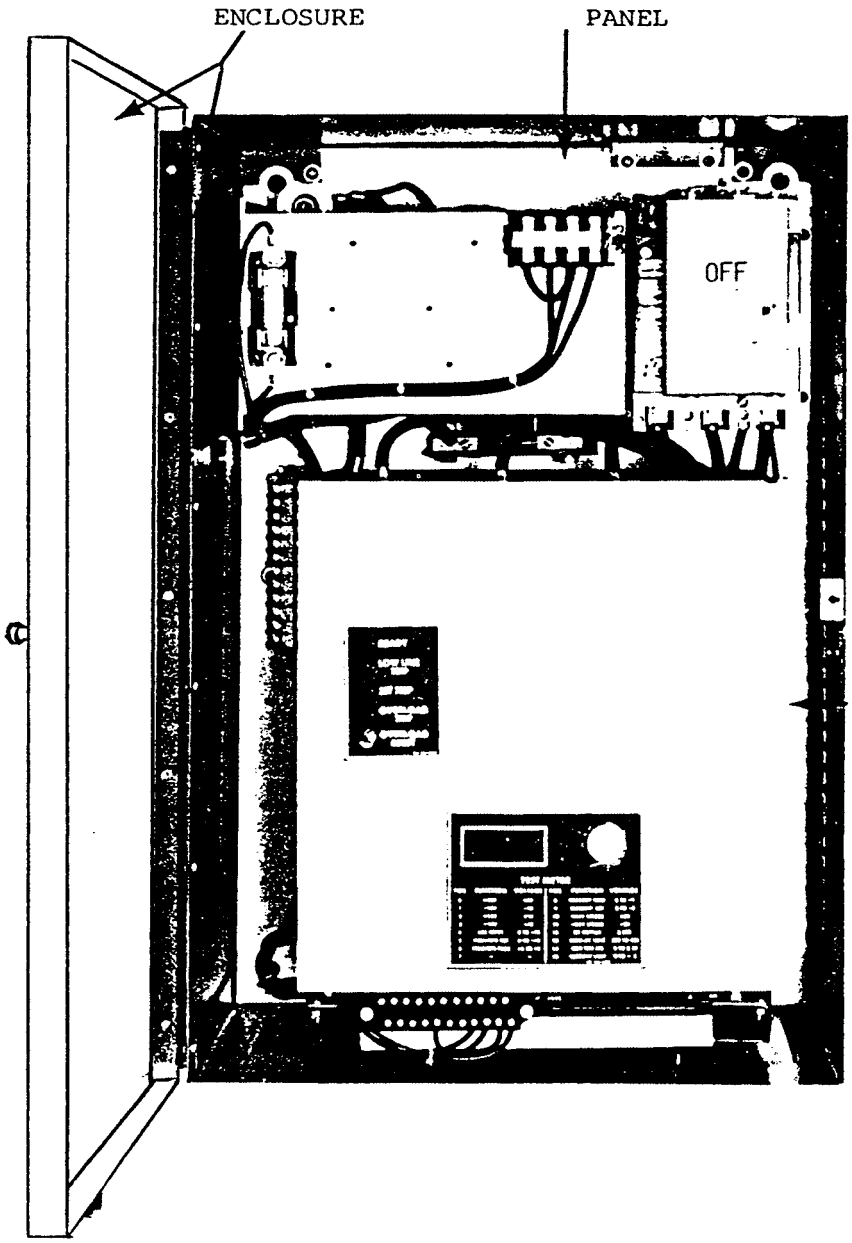


Figure 1.1 SABER 3306 Controller (5 thru 200HP)

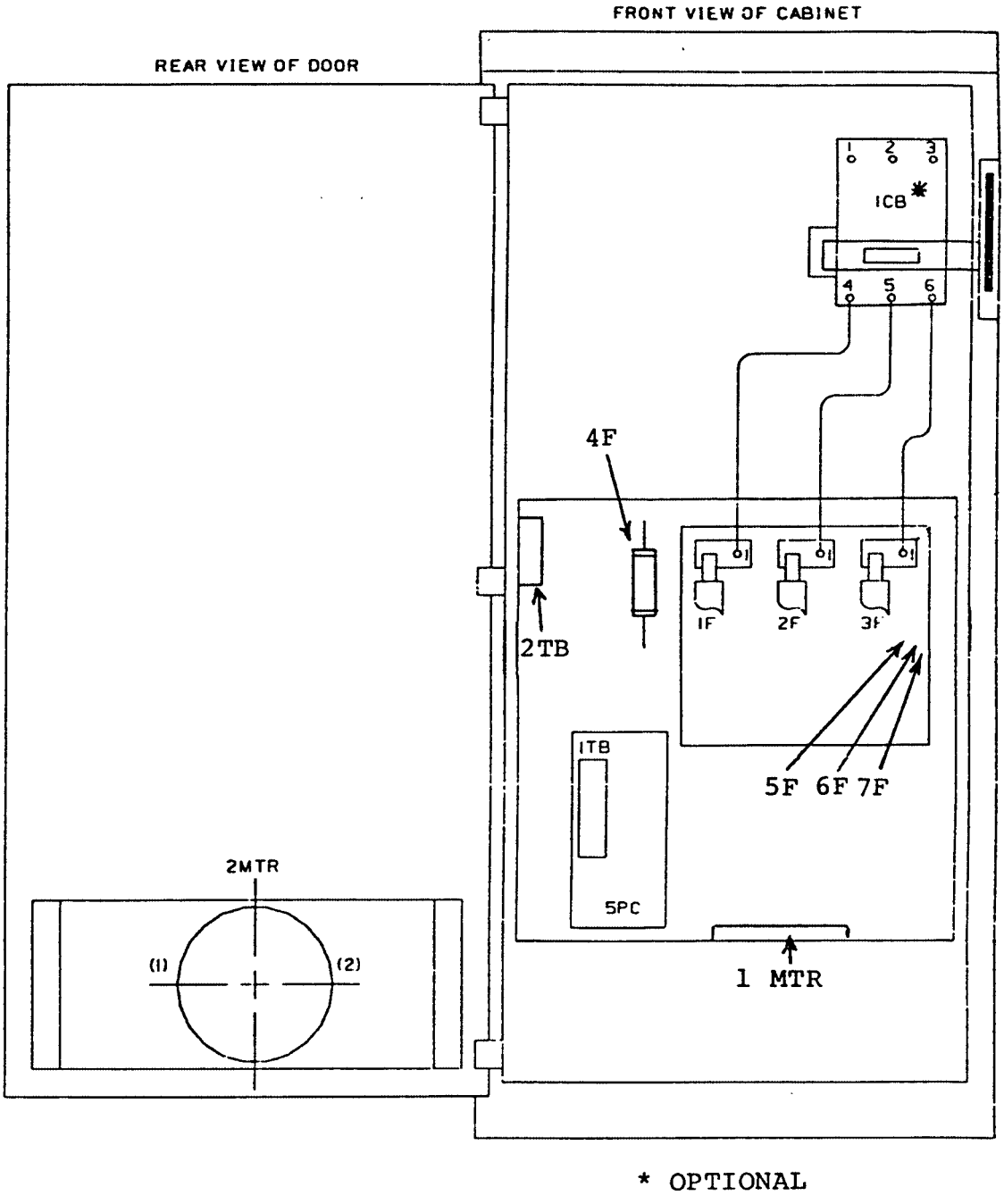
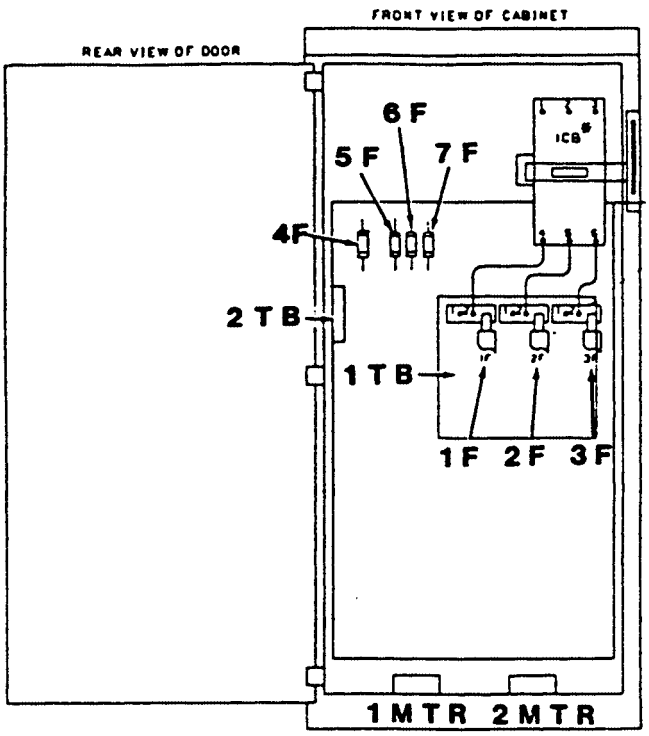
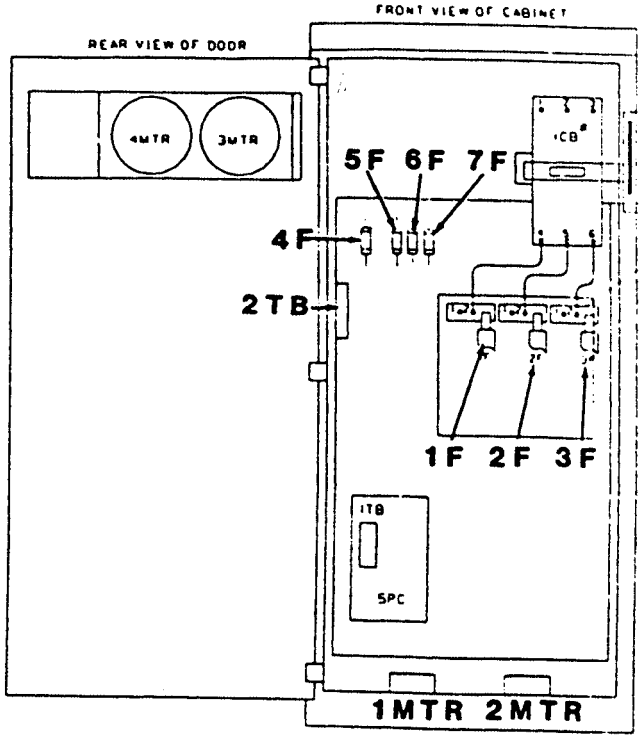


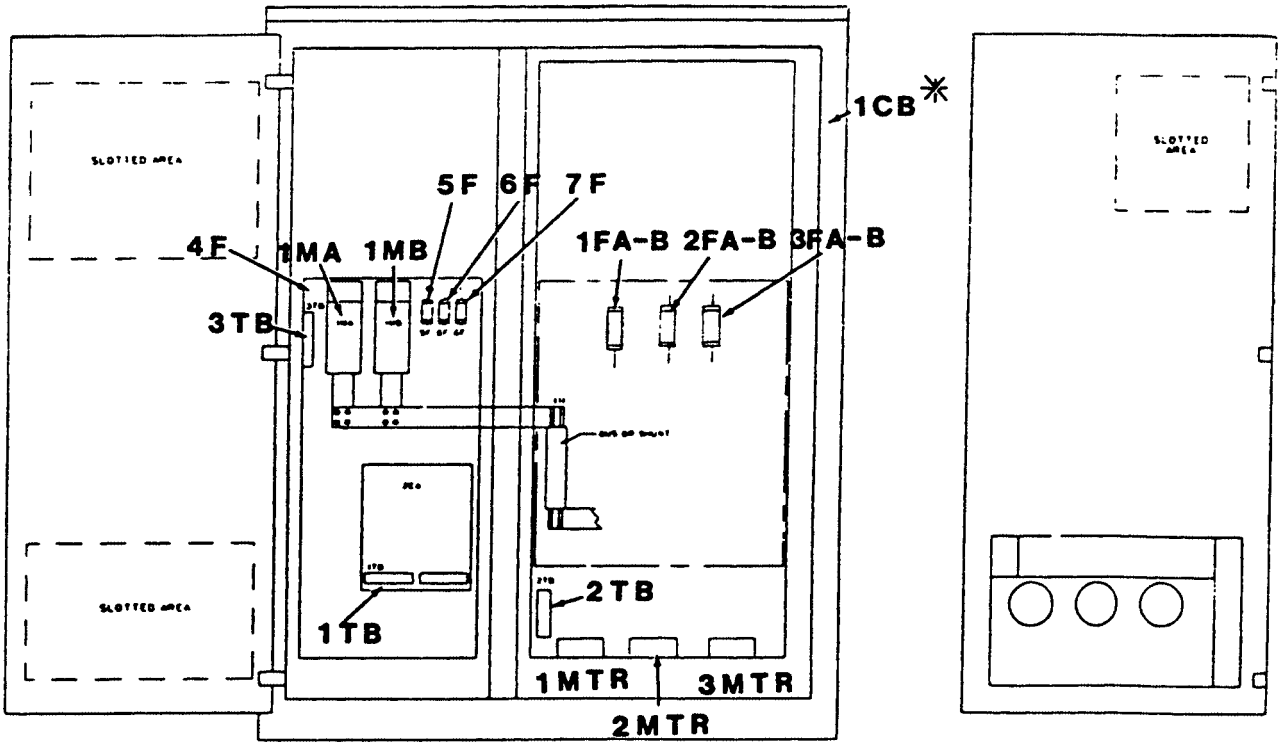
Figure 1.2 Controller (200 thru 300HP)



400 HP



500 thru 800 HP



900 thru 1000 HP

*OPTIONAL

Figure 1.3 Controller (400 thru 1000HP)

1.2 DESCRIPTION

The Saber 3306 DC static drive system consists of a Controller, a DC motor, and Operators Control Station (OCS).

The Controller, Figure 1.1 thru 1.3, is designed to control a DC motor over a wide and infinitely adjustable speed range. The Controller operates from three phase (3Ø) AC power lines.

The installation of an optional, LED readout test meter makes Controller testing and troubleshooting easier and faster.

1.3 SPECIFICATIONS

The following are general specifications for the Controller. The range of performance can be extended by adding standard Louis Allis modifications or having the Controller specially engineered.

Input Line Voltages:

230VAC, -5%, +10%
460VAC, -5%, +10%

Phase Rotation Insensitive
SPEED RANGE: 20:1
LINEAR ACCEL/DECEL: 1-40 Sec. Range
ADJUSTABLE CURRENT LIMIT: 0-200%
ELECTRONIC OVERLOAD: 115% ±6% Trip Point
SPEED REGULATION: As specified for application
SERVICE FACTOR: 1.0
AMBIENT TEMPERATURE: 10°C to 40°C
OPERATING ALTITUDE (MAX): 3300 ft. above sea level

STANDARD FIELD SUPPLY RATING

5HP to 150HP	8 Amps DC
200HP to 300HP	20 Amps DC
400HP to 1000HP	25 Amps DC

1.4 STANDARD MODIFICATIONS

Standard plug-in modifications available for the Saber 3306 DC drive are listed in Table 1.1. These modifications enable the basic controller to perform a variety of control and operational functions. Contact the nearest Louis Allis District Office for ordering information.

Installation instructions are provided later in this instruction manual, as well as included with each modification kit.

A. TEST METER (Digital)

The test meter modification is ideal for troubleshooting and may also be used to make startup adjustments. Digital readout is standard. It provides the ability to test 15 critical points including:

... Armature Volts
... Armature Amps
... Input Volts
... Reference Voltage
... Reference Voltage
... Feedback Voltage
... Critical Power Supply Points

B. S-CURVE

The S-Curve acceleration/deceleration circuit takes a signal corresponding to the desired speed from the drive speed setter and generates a time rate function to control the drive speed. This time rate signal is modified to include a fixed amount of logarithmic acceleration/deceleration control to provide smooth transition in and out of acceleration/deceleration control.

If normal stop by motoring down to rest under controlled linear deceleration is desired, refer to controlled stop modification.

Table 1.1 Standard Modifications

DESCRIPTION	NOTES	MOD: KIT MODEL NO.
TEST METER		73494
S-CURVE		73493
PRECISION REFERENCE		73492
VOLT/CURRENT FOLLOWER		73491
AUTO/MANUAL		73496
SPEED REGULATOR WITH TACHOMETER FEEDBACK		73490
THREAD		73495
CONTROLLED STOP		73497
TACH DAMPING	1	73498

NOTES: 1. Used with Speed Regulator, when required. Not to be used separately.

C. CONTROLLED STOP

Controlled stop enables a drive equipped with acceleration/deceleration control to be stopped at an adjustable controlled rate. When the normal STOP push button is pressed, the drive decelerates in a controlled rate until a preset slow speed is reached, at which time power is disconnected and the motor coasts to rest. When dynamic braking is included in the control, dynamic braking is connected across the motor armature at this preset slow speed. Louis Allis recommends installation of an E-STOP push button to bypass the Controlled Stop in case of an emergency. When the emergency stop push button is pressed, the drive will immediately coast or dynamic brake to rest.

NOTE

Deceleration time must be set longer than the normal "coast-to-stop" time for the control to have affect.

D. PRECISION REFERENCE

This modification provides a highly stable (low temperature drift) reference source capable of delivering ±10V at 40mA maximum load on each polarity output.

E. VOLT/CURRENT FOLLOWER

This modification allows the drive speed to follow an external signal source at an adjustable ratio. The source should

be isolated from ground; when the source is grounded, complete source data must accompany the incoming order. System stability is not guaranteed when the external source and drive are part of a closed loop system. The follower mod is designed to work with either a voltage or current signal within the following ranges:

Voltage	Current
0-5V	1-5mA
0-10V	2-10ma
0-65V	4-20mA
0-225V	10-50mA

When a tachometer-generator is the external signal source, the output requirements of the tachometer-generator are:

1. 5mA loading at top speed.

2. A minimum of 20 hertz from an AC tach-generator at the lowest signal the drive is to follow.

F. AUTO/MANUAL

Auto/Manual is used when the drive is required to follow more than one reference. For example, this option can be used in conjunction with the voltage/current follower option and allows signal transfer from the Follower PCB reference to a manual speed pot reference.

G. SPEED REGULATOR WITH TACHOMETER FEEDBACK

This modification permits the drive to operate with improved regulation and drift characteristics. This modification requires an integrally mounted, bearingless, AC tachometer-generator and a tach feedback printed circuit board.

1. 1% Speed Regulation

Permits speed regulation of ±1% of base speed due to load changes, and ±2% of base speed due to all other variables.

2. 0.1% Speed Regulation

Permits speed regulation of ±0.1% of base speed due to load changes, and ±0.5% of base speed due to all other variables.

H. THREAD

This modification provides for operation of the drive at adjustable preset slow speeds. Once the THREAD push button has been depressed, the speed will be maintained by means of a holding circuit. The drive will continue to run at the set speed until the STOP push button is depressed. Thread speed is limited to 30% of top speed. Price includes a transfer relay, thread control circuitry, THREAD potentiometer(located in control cabinet) and THREAD push button (located on operator's control station).

NOTE

When this mode is added to a reversing power unit, the drive will have thread capability in both forward and reverse directions. When the THREAD push button is pressed, the drive will run in the direction selected by the FORWARD/REVERSE selector switch. A single thread speed will be the same in both directions of rotation.

NOTE

Consideration should be given to motor low speed capability.

I. TACH DAMPING

The standard drive was designed for stability with loads having an inertia equal to or less than six times motor inertia. When used with loads having an

inertia greater than six times motor inertia, additional damping of the feedback signal is required. This additional damping is provided by the plug-in damping card.

J. JOG

Separately adjustable jogging is provided as standard on all Saber 3306 controls. Jogging provides for operation of the drive at adjustable, preset low speeds for as long as the JOG push button is depressed. When the JOG push button is released, the drive will stop. Jog speed is limited to 30% of top speed.

NOTE

When using a reversing power unit, the drive will have jog capability in both forward and reverse directions. When the JOG push button is pressed, the drive will jog in the direction selected by the FORWARD/REVERSE selector switch. A single jog speed setter is supplied so that jog speed will be the same in both directions of rotation.

1.5 OPTIONAL FEATURES

A. DYNAMIC BRAKING (DB)

When the STOP push button is pressed, power is immediately removed from the DC motor armature and the Dynamic Braking Resistor(s) (DBR) are placed across the armature. The motor acts as a generator while coasting to a stop, and the rotational energy is dissipated by the DBR in the form of heat, bringing the motor to a very rapid stop. Braking torque is directly proportional to speed; as speed decreases, braking torque decreases. DB resistors are normally selected to provide 150% braking torque at motor base speed.

NOTE

Dynamic braking resistors are sized to allow braking a load equal to motor inertia three times in rapid succession. If connected load exceeds motor inertia, refer application details to your local Louis Allis District Office.

NOTE

If the Controlled Stop Modification is present, the motor will decelerate at a linear rate to a preset speed. Upon reaching this preset speed, power is removed from the motor armature and the DBR is then connected across the armature.

B. REVERSING AND DYNAMIC BRAKING

This option provides for operation of the drive in either direction of rotation. The circuit includes an antiplug relay so that the drive must be stopped before it is reversed. Also includes dynamic braking as described in para. 1.5.A. OCS includes selector switch for this option.

C. CIRCUIT BREAKER

The optional circuit breaker provides a means of manually disconnecting the power unit from the AC power source. Mounted on the Controller cabinet, it is a molded case circuit breaker with an externally operated handle.

1. (5-800HP) - Mechanically interlocked with cabinet door.

2. (900-1000HP) - Electronically interlocked with cabinet door.

D. MOTOR MOUNTED BLOWER

A 3-phase, 60Hz, 230/460 volt blower motor(s) permit low speed continuous operation under rated load conditions. A thermostat is included in the blower motor(s) to ensure protection against loss of cooling air. The different types of blower motors available are:

1. Without Filter

This option provides a blower for drip-proof motors where constant ventilation independent of motor speed is required.

2. With Filter

The blower is equipped with a filter for added protection in mildly dusty environments. Filters are disposable type. For severely contaminated and dirt-laden areas with very fine dust, a totally enclosed motor is recommended.

3. Totally Enclosed Air-Over (TEAO)

Includes motor-mounted blower and shroud on top of drive motor to direct cooling air over the enclosed motor frame.

E. BLOWER MOTOR FUSES

Where blower ventilation is required on the DC motor (including TEAO and TEFC motors), this optional feature provides fused branch circuit protection which must be provided for the blower motor.

Refer to the Installation and adjustment section of this manual for blower motor fuse requirements.

1. 5 thru 150HP, see Table 2.3.

2. 200 thru 1000HP, see Table 2.4.

F. BLOWER MOTOR STARTER

An AC across-the-line blower motor starter is energized whenever power is applied to the power unit.

G. TACH GENERATORS

Foot-mounted tachometer generators are available for remote mounting by customer. They may be used for either speed indication or speed control.

1. AC Tachometer-Generator

The PHM tachometer-generator listed below is a 32-pole device with an output voltage of 28VAC/1000 RPM nominal with a maximum operating speed of 5000 RPM.

2. DC Tachometer-Generator

The tach generators listed below are supplied with solid base and single shaft extension. They are capable of operation in ambient temperatures up to 65°C.

Type	Enclosure	Volts Per 1000 RPM	Maximum Speed RPM
BC42	TENV	50VDC 100VDC 200VDC	5000 2750 1375
BC46	TENV	50VDC 100VDC 200VDC	5000

H. FIELD LOSS RELAY

The field loss relay is used to provide special protective features for a Controllers' motor in case of loss of motor field excitation. Should the field current to the motor be interrupted for any reason or drop below a preset value, the trip loss relay operates to shut down the Controller.

I. FIELD ECONOMY

The field economizing circuit reduces the motor's shunt field current to a preset low level whenever the motor's armature is disconnected.

J. AMMETER SHUNT

A 50 mV shunt allows the customer to use their own ammeter.

1.7 CONTROLLER IDENTIFICATION

A. Table 1.2 (5 thru 200HP, 53SD-REV 2).

B. Table 1.3 (200 thru 1000HP, 53SK)

Two methods have been established for identifying the Controller with various modifications.

METHOD 1

The 53SD-REV 2 or 53SK model number stamped on the Controller nameplate accurately depicts the Controller and any modifications installed at the time of manufacture. Write this number in the applicable blocks below.

5 thru 200HP

5	3	S	D	_	_	_	_	-	_	_	_	_	2
				1	2	3	4		5	6	7	8	

(Table 1.2 Block Designators)

200 thru 1000HP

5	3	S	K	_	_	_	_	-	_	_	_	_
				1	2	3	4		5	6	7	8

(Table 1.3 Block Designators)

Each block designator is identified in the applicable table. If a modification kit is installed by the customer, locate the modification in the table and change the appropriate block designator to reflect the added modification. Always refer to this number when contacting LOUIS ALLIS.

METHOD 2

If the Controller is custom designed, a serial number is assigned at the factory and stamped on the Controller nameplate. Fill in the space below:

SERIAL NUMBER _____

DATE INSTALLED _____

Always refer to the serial number when contacting LOUIS ALLIS.

Table 1.2 Identification Designators- 5 thru 200HP (53SD)

TD.1.3K.T1

DESIGNATOR	BLOCK 1		
	240V RATING HP*	500V RATING HP*	IAC / IDC
1		7 1/2	12/14
2	5	10	17/20
3	7 1/2	15	23.6/29
4	10	20	32.8/38
5		25	36/44
6	15	30	45.7/55
7	20	40	61.2/72
8	25	50	73.5/89
9	30	60	90/106
A	40	75	120/140
B	50	100	148/173
C	60	125	176/206
D	75	150	222/255
E		200	269/330

*LISTED ON NAMEPLATE

BLOCK 4 DESIGNATOR	THREAD 46S02275-0010	AUTO/MAN 46S02276-0010	CONTROLLED STOP 46S02277-0010	+15V SUPPLY OUT TO 2TB 46S02310-0C20
0				
1	X			
2		X		
3			X	
4	X	X		
5	X		X	
6		X	X	
7	X	X	X	
8				X

RELAY OPTIONS

BLOCK 6 DESIGNATOR	AC INCOMING TB	CIRCUIT BREAKER	BLOWER MCTOR FUSE	SHUNT
♦ 0				
1	X			
2		X		
3	X		X	
4	X			X
5		X	X	
6		X		X
7	X		X	X
8		X	X	X

♦ "0" IN BLOCKS 6 AND 7 INDICATES POWER CUBE ONLY.

VOLT/ SPEED MAIN OPTIONS

BLOCK 2 DESIGNATOR	MODIFICATIONS ■ TEST METER	V/C FOLL	TACH DAMP
0			
1	X		
2		X	
3	X	X	
4			X
5		X	X
6	X		X
7	X	X	X

■V/C FOLL = VOLTAGE/CURRENT FOLLOWER
TACH DAMP = TACH DAMPING

BLOCK 3 DESIGNATOR	MODIFICATIONS ▲ SPD REG	(S)	PRECIS. REF.
0			
1	X		
2		X	
3			X
4	X	X	
5		X	X
6	X		X
7	X	X	X

▲ SPD REG = SPEED REGULATOR
(S) = S-CURVE
PRECIS.REF. = PRECISION REFERENCE

BLOCK 5	CONTROLLER CONFIGURATION
0	POWER CUBE ONLY
1	240V OPEN PANEL
2	240V PANEL & ENCL.
3	500V OPEN PANEL
4	500V PANEL & ENCL.

BLOCK 8	MAJOR CHANGE INDICATOR
NOT TO BE CHANGED BY CUSTOMER	

BLOCK 7 DESIGNATOR	DRIVE CHARACTERISTICS ● NON-REV.	NON-REV. DB	REV. A-P	REV. DB A-P	FIELD ECON.	FIELD LOSS
0 ♦						
1	X					
2		X				
3			X			
4				X		
5	X				X	
6	X					X
7	X				X	X
8		X			X	
9		X				X
A		X			X	X
B			X		X	
C			X			X
D			X		X	X
E				X	X	
F				X		X
G				X	X	X

● REV. = REVERSING DB=DYNAMIC BRAKING A-P=ANTI-PLUG

Table 1.3 Identification Designators 200 thru 1000HP (53SK)

TD.I.3K.T2

BLOCK 1 DESIGNATOR	500V RATING HP*	IAC	IDC
1	200	270	330
2	250	329	403
3	300	392	480
4	400	525	643
5	500	628	770
6	600	751	920
7	700	881	1080
8	800	1032	1265
9	900	1138	1395
A	1000	1248	1530

*LISTED ON NAMEPLATE

BLOCK 4 DESIGNATOR	MODIFICATIONS ● THRD	A/M	CNTD STP
0			
1	X		
2		X	
3			X
4	X	X	
5	X		X
6		X	X
7	X	X	X

●THRD = THREAD
A/M = AUTO/MANUAL
CNTD STP = CONTROLLED STOP

RELAY OPTIONS

VOLT/ SPEED MAIN OPTIONS

BLOCK 2 DESIGNATOR	MODIFICATIONS ■ TEST METER	V/C FOLL	TACH DAMP
0			
1	X		
2		X	
3	X	X	
4			X
5		X	X
6	X		X
7	X	X	X

■V/C FOLL = VOLTAGE/CURRENT FOLLOWER
TACH DAMP = TACH DAMPING

BLOCK 3 DESIGNATOR	MODIFICATIONS ▲ SPD REG	(S)	PRECIS. REF.
0			
1	X		
2		X	
3			X
4	X	X	
5	X		X
6		X	X
7	X	X	X

▲SPD REG = SPEED REGULATOR
(S) = S-CURVE
PRECIS.REF. = PRECISION REFERENCE

BLOCK 5						
5	4	3	2	1	0	DESIGNATOR
		X	X		X	SHUNT REPLACEMENT BUS
X	X			X		SHUNT (ISH)
X	X	X	X			BLOWER FUSES
X		X				BLOWER STARTER MOD

BLOCK 6 CONTROLLER CONFIGURATION			
2	1	0	DESIGNATOR
		X	OPEN PANEL
	X	X	A.C. INPUT BUS
X	X		PANEL & ENCLOSURE
X			CIRCUIT BREAKER

BLOCK 7	NOT USED

BLOCK 8	MAJOR CHANGE INDICATOR
NOT TO BE CHANGED BY CUSTOMER	

1.8 TOOLS AND TEST EQUIPMENT

Tools and test equipment required for servicing the Controller are as follows:

A. Oscilloscope, Dual Trace, Differential Pre-amp (Tektronix 545A or equivalent).

B. Probes, X10 (all voltages except armature), and X100 (armature voltage checks).

C. Multimeter (Simpson 260 or equivalent).

D. Tachometer, Hand Held (Mod. 455, James G. Biddle Co. or equivalent).

E. Soldering Iron, 42 Watt (maximum).

F. Socket Wrench Set 1/4" to 1".

G. Metric Socket 8MM.

H. Box Wrench Set 3/8" to 1".

I. Allen Socket 9/64".

J. Screw Driver Set, Standard Blade and Phillips.

K. Torque Wrench capable of measuring inch-pounds.

SECTION 2. INSTALLATION AND ADJUSTMENT

2.1 PRE-INSTALLATION CONSIDERATIONS

2.1.1 Receipt of Shipment

All equipment is tested against defect at Louis Allis Drives & Systems. Any damages or shortages evident when the equipment is received must be reported immediately to the commercial carrier who transported the equipment. Assistance, if required, is available from the nearest Louis Allis District Office. Always refer to the Louis Allis order number, equipment description, and number stamped on the Controller nameplate when contacting Louis Allis Drives & Systems.

2.1.2 Installation Site

Select a location for installing the Controller which is clean, dry, and well ventilated, as this will minimize maintenance. Refer to Figure 2.1 for system installation dimensions.

2.1.3 Handling

The Controller is shipped bolted to a skid with the cabinet protected with a complete wrap of corrugation.

It is recommended that the cabinet be moved as close as possible to its final location by fork lift truck before it is unpacked.

WARNING

AVOID JOLTING THE EQUIPMENT DURING MOVEMENT OR UNCRATING.

2.1.4 Unpacking Instructions

Remove the protective shipping material from around the equipment. Remove all packing material. Unbolt the equipment from its crate. Inspect for loose wiring. Make sure that all contact wedges and other shipping devices have been removed.

2.1.5 Packing Instructions for Reshipment or Storage

For long periods of storage, equipment should be covered to prevent corrosion and should be placed in a clean, dry location. If possible, equipment should be stored in its original crating. Periodic inspection should be made to ensure that the equipment is dry and that no condensation has accumulated. The equipment warranty does not cover damage due to improper storage.

When packing a controller for reshipment, remove all plug-in components such as sealed relays and printed circuit boards which would be susceptible to shaking loose during transportation. These items should be packed in a small corrugated carton individually protected with soft wrapping material and the carton secured in the shipping crate.

The Controller should be bolted in a crate which provides at least 2 inches clearance. The Controller should then be wrapped in polyethylene and covered with wax impregnated double walled #250 corrugation or crated. Assistance, if required, is available from the nearest Louis Allis District Office.

2.2 INSTALLATION

Select a location for installing the Controller which is clean, dry, and well ventilated, as this will minimize maintenance. In order to attain adequate cooling the enclosure must be positioned to allow a minimum of free air space as indicated below:

Sides and Back ..... 3 inches
Top ..... 12 inches

A. 5 thru 200 HP; 53SD (Figure 2.1, 2.2)

The larger units of the 5 thru 200HP Controllers are equipped with one or two fans to ensure an adequate flow of cooling air. The Controller is designed for wall mounting and is mounted on a subpanel covered by a detachable enclosure. Remove the enclosure and hoist into position by means of the subpanel.

WARNING

FAILURE TO FOLLOW THESE INSTRUCTIONS WHEN LIFTING CABINET CAN RESULT IN PERSONAL INJURY AND PROPERTY DAMAGE.

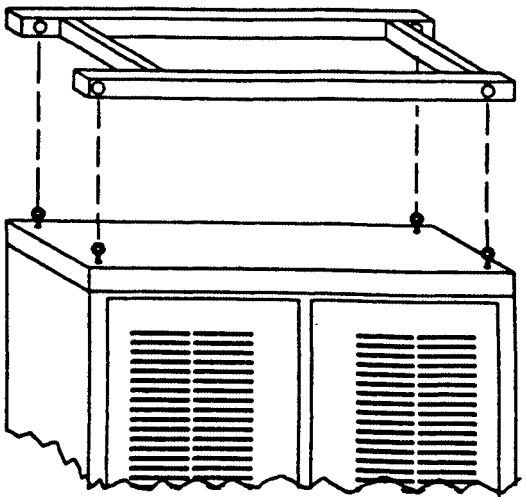
DO NOT HOIST THE CONTROLLER PANEL BY MEANS OF THE ENCLOSURE: IT WILL NOT SUPPORT THE WEIGHT OF THE CONTROLLER PANEL. REMOVE THE ENCLOSURE BEFORE LIFTING THE CONTROLLER PANEL.

USE NARROW END SHACKLES OR JAW TYPE TURNBUCKLE IN THE TWO TOP HOLES WITH 3/8 INCH MOUNTING HARDWARE TO LIFT ENCLOSURE INTO POSITION. AVOID JOLTING THE EQUIPMENT DURING MOVEMENT.

Attach the subpanel to the wall using the mounting holes in the subpanel. Ensure that the Controller is level. Replace the enclosure on the Controller.

B. 200 thru 1000HP; 53SK (Figures 2.3, 2.4, 2.5).

Lifting eyebolts have been removed and tied inside the cabinet on the lower right side of the paper rack.



The eyebolts supplied are 1/2-13 shoulder Buckeye Forge #3050 or equivalent. Insert the eyebolts into the top of the cabinet. Observe the warning below when lifting the cabinet.

WARNING

FAILURE TO FOLLOW THESE INSTRUCTIONS WHEN LIFTING CABINET CAN RESULT IN PERSONAL INJURY AND PROPERTY DAMAGE.

1. USE ONLY SHOULDER EYEBOLTS 1/2-13 BUCKEYE FORGE #3050 OR EQUIVALENT.
2. TORQUE THE EYEBOLTS UNTIL THE SHOULDER IS FIRMLY SEATED.
3. USE A SPREADER BAR ASSEMBLY TO ENSURE THE ROPES OR CHAINS CONNECTED TO THE EYEBOLTS REMAIN VERTICAL.
4. AVOID JOLTING THE EQUIPMENT DURING MOVEMENT.

Use of the spreader bar assembly will also help prevent distortion of the cabinet.

The 200 thru 1000HP Controllers are designed for floor mounting. Holes for mounting studs are provided at the bottom of each cabinet. The Controllers are designed for normal unattended operation with cabinet doors closed and locked. Front clearance must be sufficient to permit the doors to be fully opened for access. Contact closure provides remote indication of failures.

1. 200 thru 300HP

Equipped with one door fan and one heatsink fan to ensure adequate cooling air flow.

2. 400 thru 1000HP

Equipped with several fans to ensure adequate cooling air flow.

2.3 ELECTRICAL

Refer to the Interconnection Diagram in the drawing section for information on wiring the Controller to other drive system equipment. Ensure that wire size and disconnect devices conform to the installation contractor's drawings and to all applicable codes.

NOTE

In long cable runs, take care to prevent excessive voltage drop.

The leads used for speed reference, feedback, and other low level signals must be placed in conduit which is separate from conduit which is used for the motor armature, field and AC power.

Connect the shields of shielded cable at the Controller end only, as specified in interconnection tables. The far end of the shield is to be dressed neatly and left unconnected.

2.3.1 Equipment Grounding

GROUNDING NOTE

WHEN GROUNDING THE CABINET, OPERATOR'S CONTROL STATION AND/OR MOTOR VIA GROUND STUDS LOCATED WITHIN THE CABINET, ONE OF THE FOLLOWING GROUNDING KITS MUST BE USED.

46S02547-0020:	5 to 50 HP at 230V
	7.5 to 100HP at 460V
46S02547-0030:	60 and 75HP at 230V
	125 to 200HP at 460V

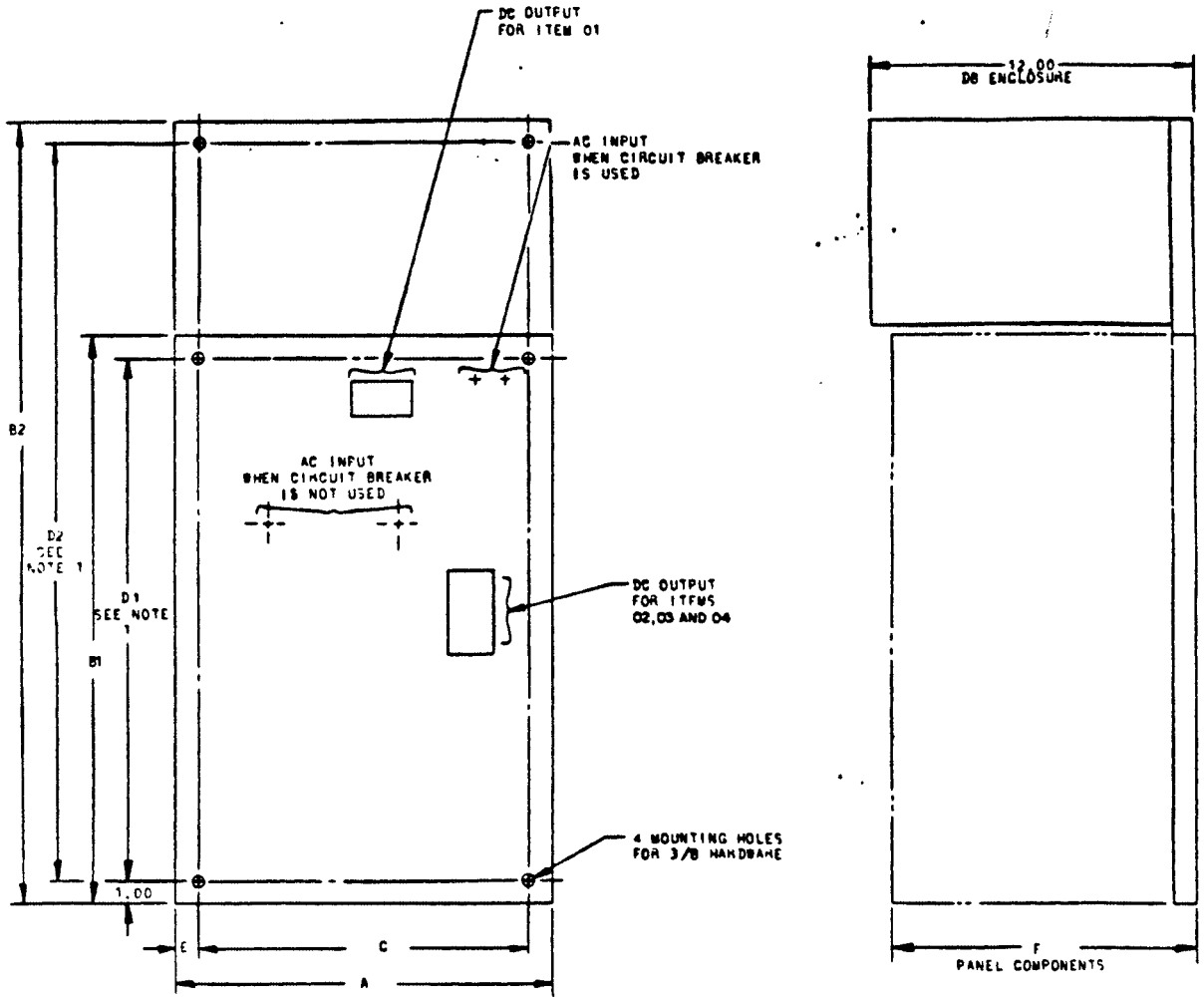
THESE KITS ARE AVAILABLE THRU YOUR LOCAL LOUIS ALLIS DISTRICT OFFICE.

2.3.2 Modification Kit Installation

If modification kits have been included as part of this unit, the schematics already depict the modification kits. If modification kits are ordered at a later date, modify the schematic with overlays as described in paragraph 6.2 SCHEMATIC MODIFICATION. REMOVE INPUT POWER and install modifications as described in SECTION 6 MODIFICATION KIT INSTALLATION.

NOTE

Ensure that continuity plugs are in place in 7CONN, 8CONN and 10CONN receptacles when modifications are not installed in these areas. See Figure 5.2. Continuity plugs are not required in 9CONN, 11CONN, and 14CONN receptacles.



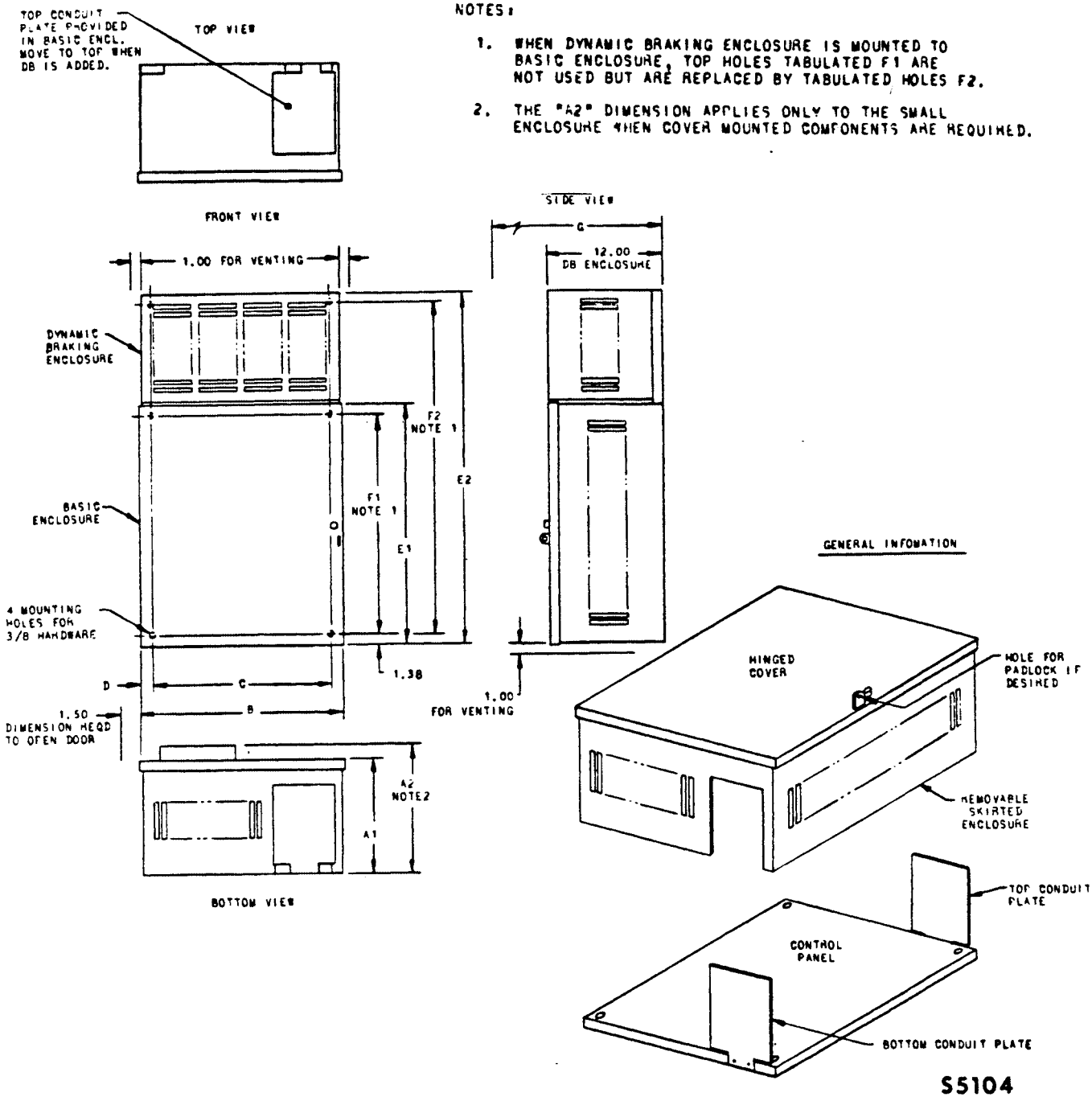
TABULATION									
ITEM	HORSEPOWER	A	B1	B2	C	D1	D2	E	F
01	5-7.5 (240V) 7.5-15 (500V)	18.00	25.00	—	16.00	23.00	—	1.00	11.75
02	10-30 (240V) 20-60 (500V)	21.00	27.00	39.00	19.25	25.00	37.00	.88	13.75
03	40-50 (240V) 75-100 (500V)	24.00	36.00	48.00	22.25	34.00	46.00	.88	13.75
04	60-75 (240V) 125-150 (500V) 200 (500V)	27.00	44.00	57.00	25.25	42.00	55.00	.88	13.75

NOTES:

1. WHEN DYNAMIC BRAKING ENCLOSURE IS MOUNTED TO PANEL, TOP HOLES TABULATED D1 ARE NOT USED BUT ARE REPLACED BY TABULATED D2 HOLES.

S5103

Figure 2.1. Installation Dimensions - Open Panel - 5 Thru 200HP



TABULATION											
ITEM	HO SEPOWER	A1	A2	B	C	D	E1	F1	E2	F2	G
01	5-7.5 (240V) 7.5-15 (500V)	12.00	14.00	18.88	16.00	1.44	25.75	23.00	—	—	30.00
02	10-30 (240V) 20-60 (500V)	14.00	—	21.88	19.25	1.31	27.75	25.00	39.50	37.00	35.00
03	40-50 (240V) 75-100 (500V)	14.00	—	24.88	22.25	1.31	36.75	34.00	48.50	46.00	38.00
04	60-75 (240V) 125-150 (500V) 200 (500V)	14.00	—	27.88	25.25	1.31	44.75	42.00	57.00	55.00	40.00

Figure 2.2. Installation Dimensions - Panel With Enclosure - 5 Thru 200HP

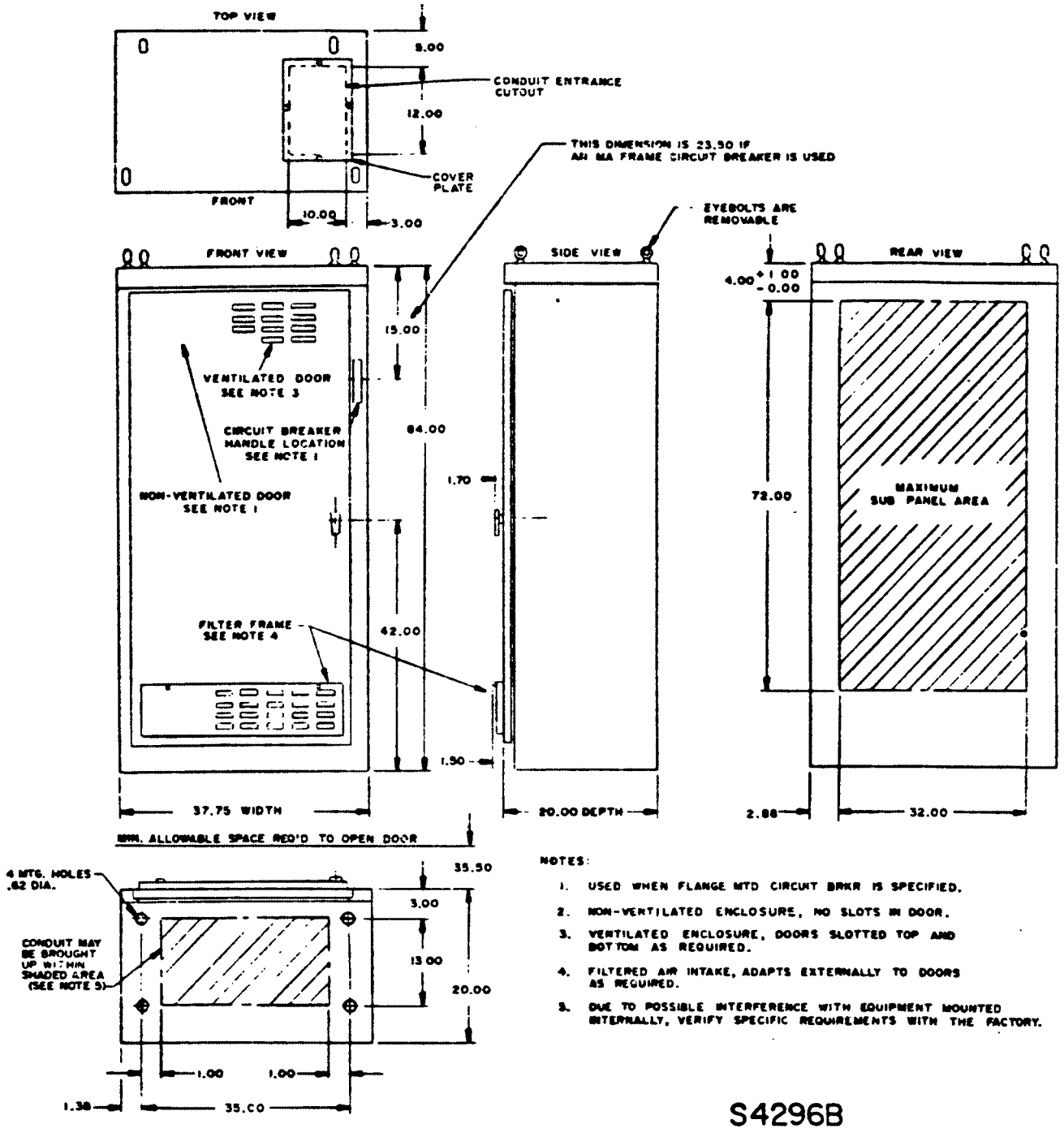
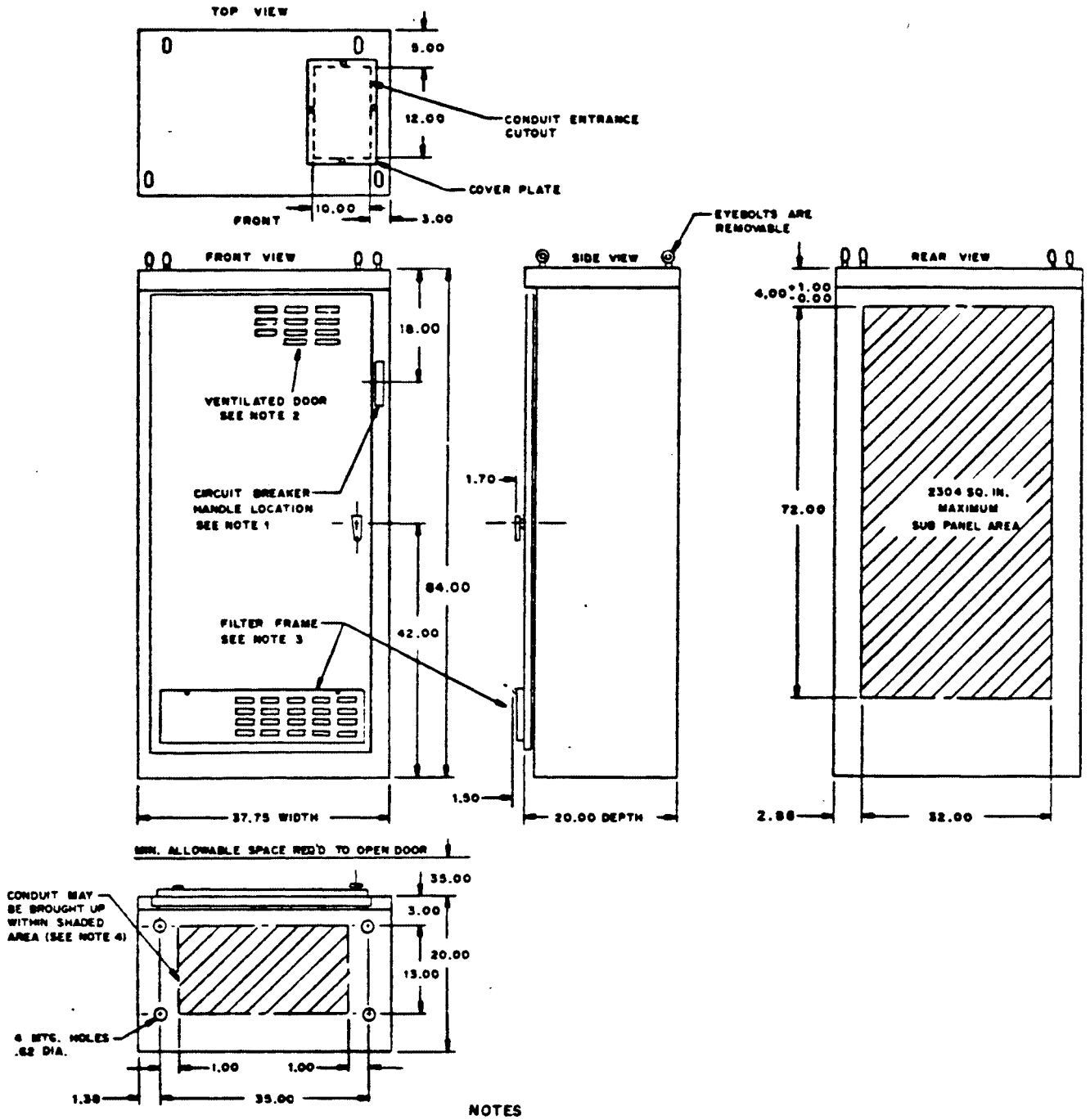


Figure 2.3. Installation Dimensions 200 Thru 300HP

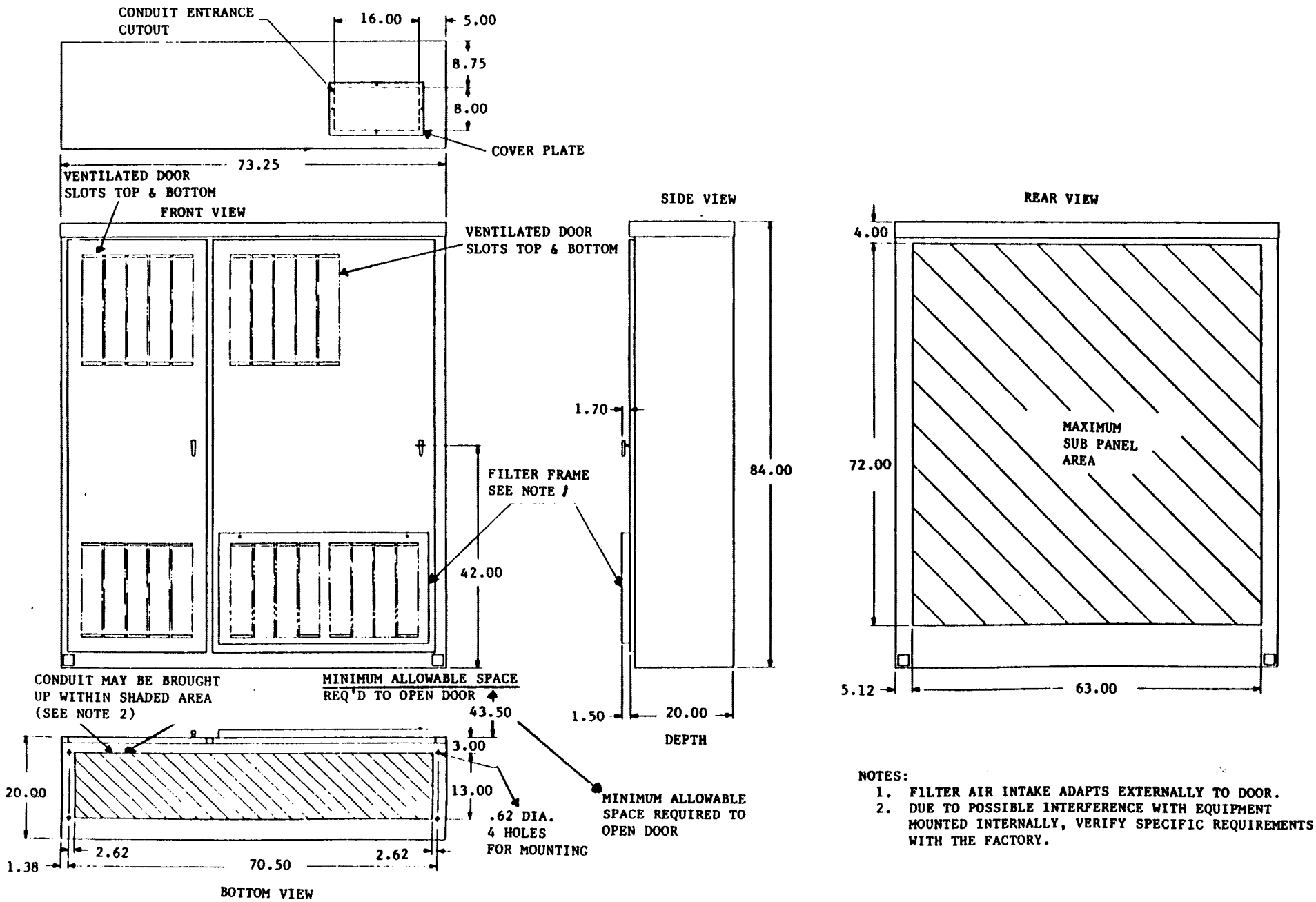


S5100

NOTES

1. USED WHEN FLANGE MTD CIRCUIT BRKR IS SPECIFIED.
2. VENTILATED ENCLOSURE, DOOR SLOTTED TOP AND BOTTOM.
3. FILTERED AIR INTAKE, ADAPTS EXTERNALLY TO DOOR.
4. DUE TC POSSIBLE INTERFERENCE WITH EQUIPMENT MOUNTED INTERNALLY, VERIFY SPECIFIC REQUIREMENTS WITH THE FACTORY.

Figure 2.4. Installation Dimensions - 400 Thru 800HP



NOTES:
1. FILTER AIR INTAKE ADAPTS EXTERNALLY TO DOOR.
2. DUE TO POSSIBLE INTERFERENCE WITH EQUIPMENT MOUNTED INTERNALLY, VERIFY SPECIFIC REQUIREMENTS WITH THE FACTORY.

Figure 2.5. Instal' 'on Dimensions - 900 Thru 1000HP

2.4 OVERLOAD PROTECTION -- (BURDEN RESISTOR SELECTION)

In addition to the DC motor thermoguard, which should always be used, an electronic thermal overload is provided to protect against overloads in excess of 115% ±6% of motor nameplate Full Load Ampere (FLA) rating, not exceeding the Controller rating.

This overload will allow 150% of motor rating for over one minute and 200% for over ten seconds. Refer to Figure 2.6 for actual trip time versus percent overload. Tripping of this overload will cause the OVERLOAD lamp to illuminate and the Run circuit to de-energize; the motor then coasts or dynamic brakes to a stop. The Controller cannot be restarted until the OVERLOAD RESET push button is pressed. If automatic reset is desired (motor restarts automatically approximately one minute after shutdown), switch 12SS (see Figure 2.7) must be set to the ON position.

NOTE

If drive shutdown is not desired, clip open jumper J3 on the Voltage/ Speed Main PCB.

WARNING

USER DOES THIS AT THE RISK OF DECREASED DRIVE PROTECTION AND VOIDING WARRANTY. LOW LINE TRIP, AUX TRIP, AND OVERLOAD TRIP WILL NO LONGER SHUT DOWN THE DRIVE. THE IST WILL STILL SHUT DOWN THE DRIVE.

2.4.1 Overload Protection (5 thru 200HP; 53SD)

Calibration resistor 1R on the Potentiometer PCB has been selected and installed at the factory, based on the horsepower and voltage rating of the unit, to provide another overload circuit called Instantaneous Static Trip (IST). IST will cause the drive to come to a stop and illuminate the IST LED when the drive unit experiences overloads in excess of 310% of motor nameplate FLA rating.

THIS OVERLOAD CANNOT BY BYPASSED. Resetting of this trip is accomplished by pressing the OVERLOAD RESET push button, 1PB, on the Potentiometer PCB.

IMPORTANT

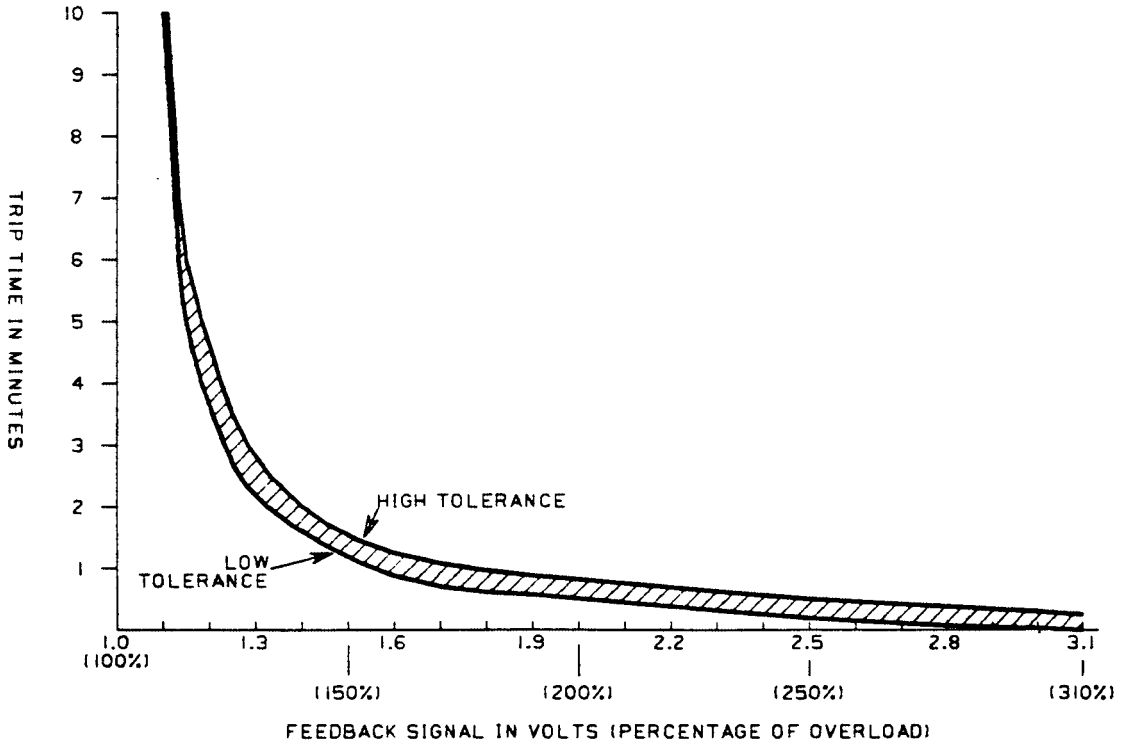
If at time of manufacture, the motor nameplate data was known, the Controller is shipped with the correct values of the overload calibration resistor 1R and Burden Resistor 2R installed.

Resistors 1R and 2R are connected in parallel. The value of 1R should not be changed, as this would affect the current range selection of 2R. Burden resistor 2R is factory selected for typical minimum expected full load current (specified on a tag attached to the Potentiometer PCB).

CAUTION

FOR ELECTRONIC OVERLOAD PROTECTION TO FUNCTION PROPERLY, BURDEN RESISTOR 2R MUST BE PROPERLY SELECTED FOR MOTOR NAMEPLATE FULL LOAD AMPERES RATING.

If motor nameplate data was not known, or a different motor is subsequently used, the customer must select the correct 2R burden resistor to match the motor nameplate full load ampere rating as depicted in Table 2.1. Additional resistors, along with a listing of their effective calibration ratings, are shipped in a bag attached to the regulator chassis.



TD.1.F10.2.2

Figure 2.6 ELECTRONIC OVERLOAD TRIP CURVE

2.4.2 Overload Protection (200 thru 300HP; 53SK)

Calibration resistor 1R is not used; the selection of burden resistor 2R is the same as discussed in 2.4.1, but using Table 2.2.

2.4.3 Overload Protection (400 thru 1000HP)

IMPORTANT

If at time of manufacture, the motor nameplate data was known, the Controller is shipped with the burden resistor (27CONN on the High HP Main Interface PCB) sized for minimum expected full load current (specified on a tag attached to the High HP Main Interface PCB).

CAUTION

FOR ELECTRONIC OVERLOAD PROTECTION TO FUNCTION PROPERLY, BURDEN RESISTOR 27CONN MUST BE PROPERLY SELECTED FOR MAXIMUM EXPECTED FULL LOAD AMPERES.

If motor nameplate data was not known, or a different motor is subsequently used, the customer must select the correct 27CONN burden resistor to match the motor nameplate full load ampere rating as depicted in Table 2.3.

Burden resistor assembly kits may be ordered from your local Louis Allis District Office. Follow instructions enclosed in the kit for proper burden resistor installation.

2.5 EXCESS OUTPUT RIPPLE CURRENT PROTECTION (400 thru 1000HP)

An output ripple current trip protection circuit is provided on the Main Interface assembly to detect that excessive output ripple current is being delivered to the motor. The ripple current may be caused by the loss of gate firing signals or a defective SCR(s), or because of misadjustment of the CURRENT GAIN potentiometer (4RH) on the Potentiometer PCB. The allowable output current ripple without drive shutdown is adjustable from 8 to 80% of rated current via the MOTOR RIPPLE TRIP potentiometer (2RH) located on the Main Interface PCB. If this circuit is tripped, the drive cannot be restarted unless the RESET push button on the Main Interface board (1PB) is pressed.

NOTE

If desired, this protection circuitry can be disabled by adding a jumper to the Main Interface PCB in the J3 position.

WARNING

USER DOES THIS AT THE RISK OF DECREASED DRIVE AND DC MOTOR PROTECTION AND THE POSSIBILITY OF VOIDING THE WARRANTY.

Table 2.1 Burden Resistor 2R Selection for 53SD Model Controllers - 5 Thru 200 HP

KIT NUMBER	1R PART NO. OHMS MARKING CODE	H.P.	VOLTS	RATED MTR FULL LOAD AMPERES	MAGNETEK D & S PART NO.(2R)	2R OHMS	RESISTANCE MARKING CODE WHEN APPLICABLE
46S02299-0010	05P00225-0102	7.5	500	12.3-12.8	05P00225-2082	127.0	127R0F
	68.1 Ohm			12.9-13.4	05P00225-0922	90.9	90R9F
	68R1F			13.5-14.0	05P00225-1722	71.5	71R5F
46S02299-0020	05P00225-0092	10	500	17.0-17.4	05P00225-1612	38.3	38R3F
	47.5 Ohm			17.5-17.9	05P00225-1582	34.8	34R8F
	47R5F			18.0-18.4	05P00225-1552	31.6	31R6F
		5	240	17.9-18.5	05P00225-1552	31.6	31R6F
				18.6-19.1	05P00225-1742	28.7	28R7F
				19.2-19.8	05P00225-2052	26.1	26R1F
46S02299-0030	05P00225-1652	15	500	25.2-25.8	05P00225-1892	14.7	14R7F
	43.2 Ohm			25.9-26.4	05P00225-1872	14.0	14R0F
	43R2F			26.5-27.0	05P00225-1852	13.3	13R3F
		7.5	240	26.5-27.3	05P00225-1852	13.3	13R3F
				27.4-28.1	05P00225-1832	13.4	12R4F
				28.2-29.0	05P00225-1822	11.8	11R8F
46S02299-0040	05P00225-0012	20	500	32.1-33.1	05P00225-1572	34.0	34R0F
	10 Ohm			33.2-34.1	05P00225-1742	28.7	28R7F
	10R0F			34.2-35.1	05P00225-0062	24.9	24R9F
		10	240	35.3-36.3	05P00225-2022	21.5	21R5F
				36.4-37.3	05P00225-1972	19.1	19R1F
				37.4-38.4	05P00225-1942	17.4	17R4F
46S02299-0050	05P00225-0092	25	500	40.6-41.7	05P00225-2032	22.6	22R6F
	47.5 Ohm			41.8-42.8	05P00225-2012	21.0	21R0F
	47R5F			42.9-44.0	05P00225-1992	20.0	20R0F
46S02299-0060	05P00225-1652	30	500	48.6-50.0	05P00225-1912	15.8	15R8F
	43.2 Ohm			50.1-51.5	05P00225-1892	14.7	14R7F
	43R2F			51.6-53.0	05P00225-1872	14.0	14R0F
		15	240	52.0-53.3	05P00225-1862	13.7	13R7F
				53.4-54.7	05P00225-1842	13.0	13R0F
				54.8-56.1	05P00225-1832	12.4	12R4F
46S02299-0070	05P00225-0092	40	500	64.7-66.4	05P00225-1662	45.3	45R3F
	47.5 Ohm			66.5-68.2	05P00225-1642	41.2	41R2F
	47R5F			68.3-70.0	05P00225-1602	37.4	37R4F
		20	240	70.0-71.2	05P00225-1582	34.8	34R0F
				71.3-72.4	05P00225-0082	33.2	33R2F
				72.5-73.6	05P00225-1552	31.6	31R6F

Table 2.1 Burden Resistor 2R Selection for 53SD Model Controllers - (5 Thru 200 HP) - continued

KIT NUMBER	1R PART NO. OHMS MARKING CODE	H.P.	VOLTS	RATED MTR FULL LOAD AMPERES	MAGNETEK D & S PART NO. (2R)	2R OHMS	RESISTANCE MARKING CODE WHEN APPLICABLE
46S02299-0080	05P00225-0092 47.5 Ohm 47R5F	50	500	81.5-84.0	05P00225-2032	22.6	22R6F
				84.1-86.5	05P00225-2012	21.0	21R0F
				86.8-89.0	05P00225-1982	19.6	19R6F
		25	240	86.5-88.3	05P00225-1982	19.6	19R6F
				88.4-90.1	05P00225-1962	18.7	18R7F
				90.2-92.0	05P00225-1952	17.8	17R8F
46S02299-0090	05P00225-1652 43.2 Ohm 43R2F	60	500	97.0-100.0	05P00225-1912	15.8	15R8F
				100.1-103.0	05P00225-1892	14.7	14R7F
				103.1-106.0	05P00225-1872	14.0	14R0F
		30	240	104.0-106.0	05P00225-1862	13.7	13R7F
				106.1-108.0	05P00225-1852	13.3	13R3F
				108.1-110.0	05P00225-1842	13.0	13R0F
46S02299-0100	05P00225-2072 51.1 Ohm 51R1F	75	500	121.0-124.0	05P00225-0052	22.1	22R1F
				124.1-127.0	05P00225-2012	21.0	21R0F
				127.1-130.0	05P00225-1992	20.0	20R0F
		40	240	138.0-140.6	05P00225-1932	16.9	16R9F
				140.7-143.3	05P00225-1922	16.2	16R2F
				143.4-146.0	05P00225-1902	15.4	15R4F
46S02299-0110	05P00225-1352 44.2 Ohm 44R2F	100	500	161.0-164.6	05P00225-1842	13.0	13R0F
				164.7-168.3	05P00225-1832	12.4	12R4F
				168.4-172.0	05P00225-1822	11.8	11R8F
		50	240	169.0-174.3	05P00225-1822	11.8	11R8F
				174.4-179.6	05P00225-1802	11.0	11R0F
				179.7-185.0	05P00225-1782	10.5	10R5F
46S02299-0120	05P00225-0012 10 Ohm 10R0F	125	500	198.0-202.3	05P00225-1532	30.1	30R1F
				202.4-206.6	05P00225-2062	26.7	26R7F
				206.7-211.0	05P00225-2042	24.3	24R3F
		60	240	203.0-209.0	05P00225-2052	26.1	26R1F
				209.1-215.0	05P00225-2032	22.6	22R6F
				215.1-221.0	05P00225-2002	20.5	20R5F
46S02299-0130	05P00225-0012 10 Ohm 10R0F	150	500	238.0-242.6	05P00225-1882	14.3	14R3F
				242.7-247.3	05P00225-1862	13.7	13R7F
				247.4-252.0	05P00225-1842	13.0	13R0F
		75	240	253.0-259.0	05P00225-0042	12.1	12R1F
				259.1-265.0	05P00225-1812	11.3	11R3F
				265.1-271.0	05P00225-1792	10.7	10R7F

Table 2.1 Burden Resistor 2R Selection for 53SD Model Controllers (5 Thru 200HP) - continued

KIT NUMBER	1R PART NO. OHMS MARKING CODE	H.P.	VOLTS	RATED MTR FULL LOAD AMPERES	MAGNETEK D & S PART NO. (2R)	2R OHMS	RESISTANCE MARKING CODE WHEN APPLICABLE
46S02299-0172	05P00225-1832 12.4 Ohm (2 parallel for 6.2 ohm)	200	500	312-318 319-325 326-332 333-339 340-342	05P225-1862 05P225-2132 05P225-2122 05P225-1802 05P225-2112	13.7 12.7 11.5 11.0 10.2	13R7F 12R7F 11R5F 11ROF 10R2F

Table 2.2 Burden Resistor 2R Selection for 53SK Model Controllers (200 Thru 300 HP)

KIT NUMBER 46S2299	H.P.	RATED MTR. FULL LOAD AMPERES	MAGNETEK D & S PART NO. (2R) 05P00225	KIT RESISTORS OHMS	RESISTOR MARKING CODE
-0140	200	308-315 315-322 322-329 329-336 336-343	-0182 -0162 -0142 -0132 -0282	274 221 178 150 127	2741F 2211F 1781F 1501F 1271F
-0150	250	390-398 398-412	-2232 -1692	61.9 54.9	61R9F 54R9F
-0160	300	465-478 478-490 490-503	-1592 -0082 -1552	35.7 33.2 31.6	35R7F 33R2F 31R6F

Table 2.3 Burden Resistor RB Selection for 53SK Model Controllers (400 Thru 1000HP)

27CONN ASSY. KIT 46S2299	H.P.	RATED MTR. FULL LOAD AMPERES	MAGNETEK D & S PART NO. (RB) 05P00225	KIT RESISTORS OHMS	RESISTOR MARKING CODE
-0180	400	615-630 630-645 645-660	-2192 -1342 -1682	52.3 49.9 48.7	52R3F 49R9F 48R7F
-0190	500	700-710 710-725 725-745 745-760 760-775 775-790 790-810 810-830	-1662 -1352 -1652 -0942 -1642 -1632 -0572 -1612	45.3 44.2 43.2 42.2 41.2 40.2 39.2 38.3	45R3F 44R2F 43R2F 42R2F 41R2F 40R2F 39R2F 38R3F

Table 2.3 Burden Resistor RB Selection for 53SK Model Controllers (400 Thru 1000HP) - continued

27CONN ASSY. KIT 46S2299	H.P.	RATED MTR. FULL LOAD AMPERES	MAGNETEK D & S PART NO. (RB) 05P00225	KIT RESISTORS OHMS	RESISTOR MARKING CODE
		830-848	-1602	37.4	37R4F
		848-867	-1362	36.5	36R5F
		867-887	-1592	37.7	35R7F
		887-907	-1582	34.8	34R8F
-0200	600	907-928	-1572	34.0	34R0F
		928-950	-0082	33.2	33R2F
		950-972	-1562	32.4	32R4F
		972-995	-1552	31.6	31R6F
		995-1015	-0092	47.5	47R5F
		1015-1038	-1672	46.4	46R4F
		1038-1062	-1662	45.3	45R3F
-0210	700	1062-1085	-1352	44.2	44R2F
		1085-1110	-1652	43.2	43R2F
		1110-1134	-1652	43.2	43R2F
		1134-1161	-1642	41.2	41R2F
		1161-1188	-1632	40.2	40R2F
		1188-1214	-1622	39.2	39R2F
		1214-1244	-1612	38.3	39R3F
-0220	800	1244-1272	-1602	37.4	37R4F
		1271-1300	-1362	36.5	36R5F
		1300-1330	-1592	35.7	35R7F
		1330-1361	-1582	34.8	34R8F
		1361-1392	-1572	34.0	34R0F
-0230	900	1392-1424	-0082	33.2	33R2F
		1424-1458	-1562	32.4	32R4F
		1458-1492	-1552	31.6	31R6F
		1492-1527	-1542	30.9	30R9F
-0240	1000	1527-1564	-1532	30.1	30R1F
		1564-1600	-1522	29.4	29R4F

2.6 BLOWER MOTOR FUSE SELECTION (53SD Model; 5 thru 200HP)

When the blower motor control optional feature is included, the fusing for the blower motor circuit must be correctly chosen to meet requirements of the National Electrical Code (NEC), Sections 430-32 and 52. The fuses supplied by Louis Allis are selected for nominal rating of Louis Allis blower motors. For the specific application, or when the customer uses a different blower motor, a different fuse may be required.

IMPORTANT

When a size 0 blower motor starter (05P00053-0303) is provided, 10 amp (05P00017-0027) fuses must be used for protection.

When a starter is not used, the current rating of fuses used for blower motor branch circuit protection or blower motor running overload protection are to be selected from Table 2.4. The voltage rating of the fuses must be greater than the voltage rating of the blower motor. Fuses used for branch blower motor protection must be sized for 150 to 175% of full load blower motor current. Fuses used for blower motor running overload protection must be sized no greater than 115% of full load blower motor current. Identify full load blower motor current from the Full Load Ampere (FLA) rating on the blower motor nameplate.

2.7 BLOWER MOTOR FUSE SELECTION (53SK Model; 200 thru 1000HP)

When the blower motor control optional feature is included, the fusing for the blower motor circuit must be correctly chosen to meet requirements of the National Electrical Code (NEC), Sections 430-32 and 52. The fuses supplied by Louis Allis are selected for nominal rating of Louis Allis blower motors. For the specific application, or when the customer uses a different blower motor, a different fuse may be required.

IMPORTANT

When a size 0 blower motor starter (05P00053-0303) is provided, 10 amp (05P00017-0027) fuses must be used for protection.

When a starter is not used, the current rating of fuses used for blower motor branch circuit protection or blower motor running overload protection are to be selected from Table 2.5. The voltage rating of the fuses must be greater than the voltage rating of the blower motor. Fuses used for branch blower motor protection must be sized for 150 to 175% of full load blower motor current. Fuses used for blower motor running overload protection must be sized no greater than 115% of full load blower motor current. Identify full load blower motor from the Full Load Amperes (FLA) rating on the blower motor nameplate.

Table 2.4. Blower Motor Fuse Selection (53SD Model, 5 thru 200HP)

CURRENT RATING * OF FUSES (AMPS)	FUSE VOLTAGE RATING (VAC)	LOUIS ALLIS PART NUMBER	QUANTITY REQUIRED
0.6	230	05P00017-0202	3
1.6		05P00017-0192	3
5.0		05P00017-0203	3
0.3	460	05P00017-0195	3
0.8		05P00017-0204	3
2.5		05P00017-0205	3

* Fuses rated above 1 ampere must be Dual Element.

Recommended fuse manufacture:

Fusetron:
Type FRN for 250 VAC or less.
Type FRS for 251 VAC or above.
Economy:
Type ECN for 250 VAC or less.
Type ECS for 251 VAC or above.

Other manufacturers' fuses may be used if their electrical characteristics are equivalent to either of the above.

Table 2.5. Blower Motor Fuse Selection (53SK Model, 200 thru 1000HP)

CURRENT RATING * OF FUSES (AMPS)	FUSE VOLTAGE RATING (VAC)	LOUIS ALLIS PART NUMBER	QUANTITY REQUIRED
1.0	460	05P00017-0225	3
1.12		05P00017-0193	3
1.8		05P00017-0206	3
2.0		05P00017-0247	3
2.5		05P00017-0205	3
3.2		05P00017-0197	3
3.5		05P00017-0199	3
5.0		05P00017-0201	3
6.25		05P00017-0239	3
10.00		05P00017-0027	3

* Fuses rated above 1 ampere must be Dual Element.

Recommended fuse manufacture:

Fusetron:
Type FRN for 250 VAC or less.
Type FRS for 251 VAC or above.
Economy:
Type ECN for 250 VAC or less
Type ECS for 251 VAC or above.

Other manufacturers' fuses may be used if their electrical characteristics are equivalent to either of the above.

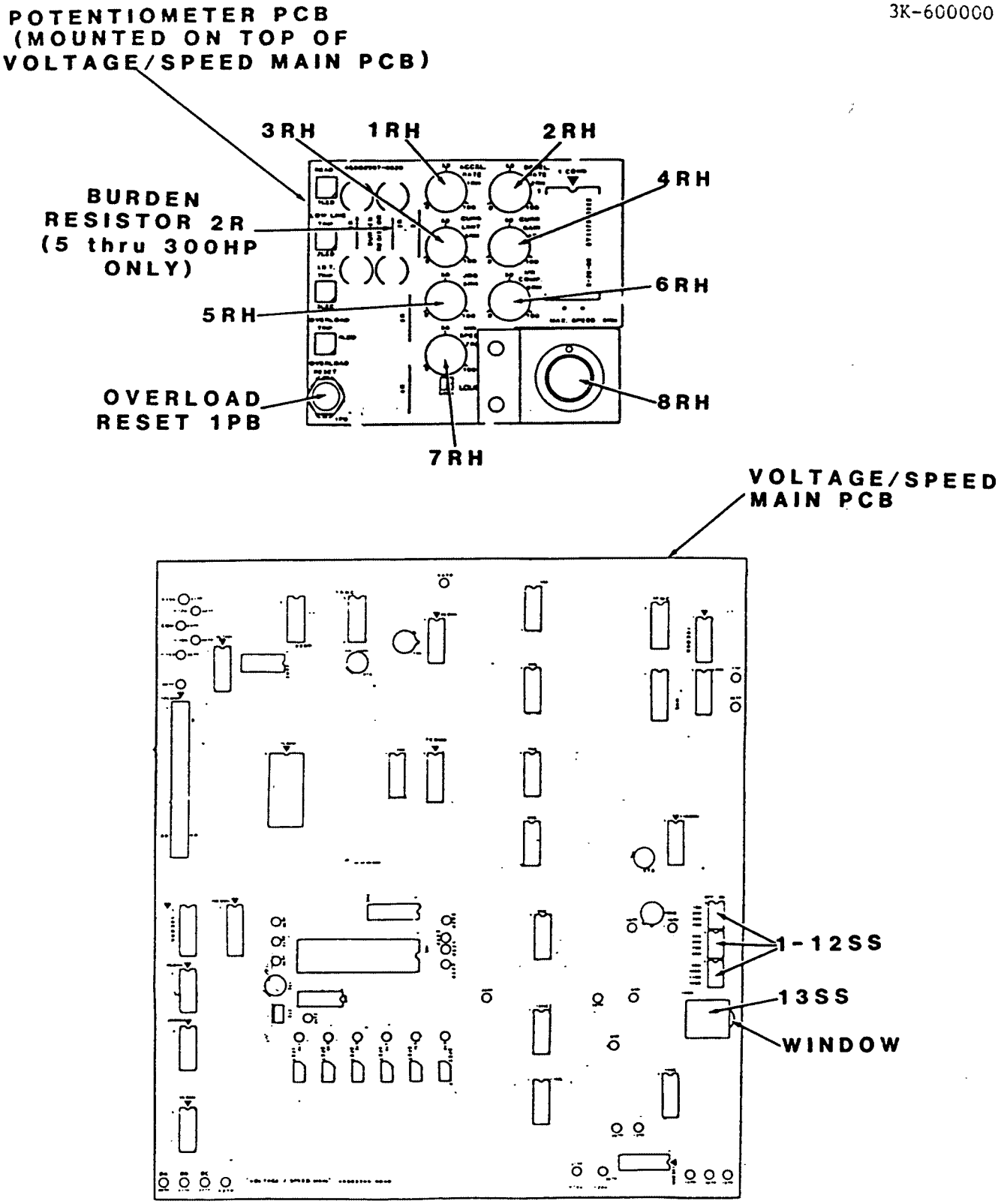


Figure 2.7. Location of Adjustment Controls

2.8 INITIAL ADJUSTMENTS - NO POWER APPLIED

The switches on the Volt/Speed Main PCB and the pots on the Potentiometer PCB (see Figure 2.7) are factory adjusted to initial settings. Before energizing the Controller, ensure that all settings agree with the factory set-up recorded on the inside of the Controller cover. If site application requirements differ from factory setup conditions, the settings will be changed during the following procedure.

2.8.1 Switch Set-Up for Standard Voltage Regulator

A. Ensure that thumbwheel switch 13SS, for low line trip calibration, is set according to incoming line voltage.

3Ø AC Line Voltage	Position (seen through window)
460	2
415	3*
380	4*
230	5
220	6*

* NOTE: When an incoming line voltage other than 460 or 230 is used, the control transformer primary voltage, DC motor armature and field voltages must be compatible with the incoming voltage.

B. Refer to Table 2.6 and verify switch positions.

2.8.2 Initial Pot Adjustments

A. Pots 1RH thru 8RH on the Potentiometer PCB are factory set, and should not require any futher adjustment prior to application of power. (Settings may be checked against the factory setup, recorded on the inside of the Controller cover).

NOTE

CURRENT LIMIT (3RH), CURRENT GAIN (4RH) and IR COMP (6RH) should NOT be changed from their factory settings unless required by the the drive application.

B. On Operator Control Station, set SPEED to 0% (Fully CCW).

2.9 ADJUSTMENTS-ENERGIZED DRIVE

A. Connect a voltmeter from 14TP to 33TP (common) on the Volt/Speed Main PCB (or set Test meter mod to position 15).

B. Apply incoming 3Ø, 50/60Hz power to controller.

1. Note green READY lamp is on and all red lamps are off.

2. Note meter connected in step A reads -3.75V. This verifies that current limit is set for 150%. If reading is incorrect, adjust 3RH to obtain -3.75V.

3. Leave meter connected.

Table 2.6. Controller Switch Functions

SWITCH	FUNCTION	ON	OFF
1SS	LAC TIME RANGE	7-40 Sec.	1-7 Sec.
2SS	JOG	Internal	External
3SS	FDBK CAL.	500VDC	240VDC
4SS	TEST METER CAL.	500VDC	240VDC
5SS	VOLT/SPEED	VOLT REG	SPEED REG ** (tach feedback)
6SS	IR COMP	BOOST IN SPEED	DROOP IN SPEED
Do not change the positions of switches 7SS thru 11SS unless specified by the factory, or according to adjustments in modification instruction sheets.			
7SS	IR COMP DELAY	ALWAYS ON	
8SS	CURRENT REF	ALWAYS ON	
9SS	CURRENT GAIN	ALWAYS ON	
10SS	CURRENT COMPARATOR MOD	ALWAYS ON	
11SS	10/7.5V REF	ALWAYS ON (-10V)	
12SS	OVERLOAD TRIP RESET	AUTOMATIC	MANUAL RESET

** NOTE: Speed Reg Mod required.

C. Field Loss Protection Assembly Adjustments (200 thru 1000HP)

WARNING

BEFORE REMOVING OR REPOSITIONING ANY FIELD WIRING AT 2TB ON THIS ASSEMBLY, ENSURE THAT ALL INCOMING POWER IS OFF.

The OFFSET adjustment pot (3RH) is adjusted at the factory and normally should not require adjustment. However, if misadjusted, its function and adjustment procedure are as follows.

1. With no field current applied to the motor (remove the wire from 2TB-8 on this assembly to ensure zero field current), the voltage at 1TP (with respect to 3TP) should be zero. If it is not zero, adjust 3RH to obtain zero volts on 1TP. Reconnect wire to 2TB-8.

2. Refer to the motor nameplate and determine the rated motor field current in amperes.

3. Any one of three suffix versions of the Field Loss Protection assembly may have been provided with this Controller depending on the drive horsepower rating. The differences between them are the number of turns of wire and the gauge of the wire on terminal board 2TB. See Table 2.8 for turns, wire gauge, and current range.

Factory installed field loss wiring is always connected to winding #2 between terminals 2TB-8 and 9. However, the current range of this winding may not encompass the rated field current of your motor as determined by your comparison of the motor nameplate versus Table 2.8. If this is the case, change the current rating of the Field Loss Protection assembly by removing the external wire from terminal 2TB-9 and installing it into 2TB-7.

4. Energize the motor field. At nameplate rated field current, the voltage between 1TP and 3TP should be +2.0VDC. If not, adjust the CALIBRATION pot (2RH) until the voltage is +2.0VDC.

NOTE

If the motor is cold, the field current may be higher than the rated value and there may be a time delay while waiting for the motor to attain its normal operating temperature and field current.

5. Reference the schematics to determine the applicability of this step. If the Controller is not equipped with a field weakening regulator option (part numbered 46S2484-), the TRIP LEVEL pot (1RH) SHOULD BE SET TOTALLY CLOCKWISE (with the arrow pointing at the 100 position).

If the Controller is equipped with the field weakening regulator, then the minimum field current required must be determined and 1RH must be set accordingly.

EXAMPLE: For a 3.0 amp field weakened to 0.75 amps, the field weakening percent equals:

$$\frac{0.75}{3.0} \text{ or } 25\%$$

Since the adjustment range of 1RH is from 10-80% of rated field current, the pot setting which corresponds to 25% for this example would be:

$$\frac{80}{100} \times \frac{25}{SET}$$

$$SET = \frac{2500}{80} = 31.25$$

For this example, the TRIP LEVEL would be set slightly higher than the 30 on the pot.

If the field is weakened to 10% of its rated value, the TRIP LEVEL should be set totally counterclockwise (with the arrow pointing to the zero position).

Table 2.7. Function Of Pots on Potentiometer Adjustment PCB

REFERENCE DESIGNATOR	CONTROL NAME	FUNCTION
1RH	ACCEL RATE	Sets acceleration rate of drive. Turning pot clockwise increases acceleration rate.
2RH	DECEL RATE	Sets deceleration rate of drive. Turning pot clockwise increases deceleration rate.
3RH	CURRENT LIMIT	Limits maximum average drive current available. Turning pot clockwise increases current available.
4RH	CURRENT GAIN	Sets response limit of current regulator. Turning pot clockwise provides for faster current regulator.
5RH	JOG	Sets jog speed when JOG mode internal is selected. Turning pot clockwise increases jog speed.
6RH	IR COMP	When switch 6SS is set to ON: Sets amount of speed boost (regulation) when motor becomes loaded. Turning pot clockwise increases speed under load. When switch 6SS is set to OFF: Sets amount of speed droop when motor becomes loaded. Turning pot clockwise decreases speed under load.
7RH	MIN SPEED	Sets minimum speed of drive. Turning pot clockwise increases minimum operating speed.
8RH	MAX SPEED *	Sets maximum speed of drive. Turning pot clockwise increases maximum operating speed.

* Ten-turn potentiometer.

Table 2.8. Field Loss Protection

PART NUMBER 46S02493 -	FIELD CURRENT RANGE	NUMBER OF TURNS WINDING #1	NUMBER OF TURNS WINDING #2	WIRE GAGE
-0010	0.50A - 1.50A	15		20
	1.5A - 5.00 A		5	18
-0020	1.50A - 5.00A	5		18
	5.00A - 12.50A		2	14
-0030	5.00 A - 12.50 A	2		14
	12.50A - 25.00 A		1	10

Table 2.9. Function Of Pots On Field Loss Protection PCB (200 thru 1000HP)

REFERENCE DESIGNATOR	CONTROL NAME	FUNCTION
1RH	TRIP LEVEL	Sets the minimum allowable motor field current before the drive is tripped off of the line.
2RH	CALIBRATION	Sets the output of the sense amplifier on the assembly for exactly ±2VDC with rated motor field current applied.
3RH	OFFSET	Sets the output of the sense amplifier on the assembly for zero volts out with zero motor field current applied.

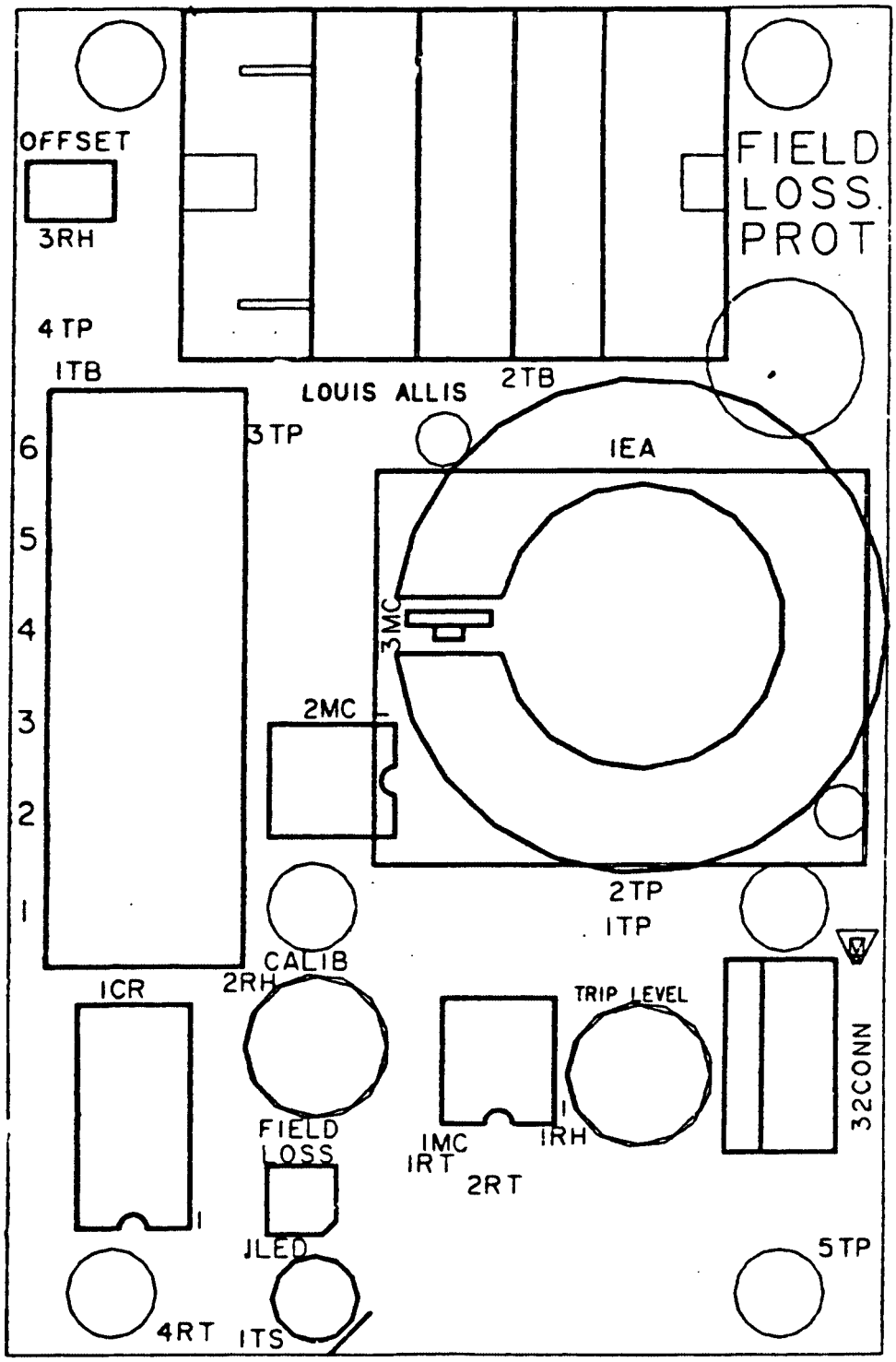


Figure 2.8 Field Loss Protection PCB
(200 thru 1000 HP, 53SK)

Para. 2.9 Cont'd.

D. Press RUN push button.

E. Slowly turn SPEED control clockwise and observe motor speed increase.

F. With SPEED control fully clockwise, turn MAX SPEED pot clockwise until desired maximum operating speed is reached. Do not set MAX SPEED pot to a setting which will allow a motor speed or armature voltage higher than that indicated on the motor nameplate.

G. Turn SPEED control fully counterclockwise and observe motor speed decrease.

H. Turn MIN SPEED pot clockwise until desired minimum operating speed is reached.

I. Stop drive and turn ACCEL RATE and DECEL RATE pots counterclockwise to 0%.

J. Turn SPEED control fully clockwise and energize controller. Note the time it takes for motor to reach maximum speed. If shorter acceleration time is desired, adjust ACCEL RATE pot to increase acceleration rate. Stop and start drive several times and adjust pot until desired acceleration rate is obtained.

K. With motor running at maximum speed, turn SPEED control rapidly to fully counterclockwise. Note the time it takes for motor to reach minimum speed. If longer deceleration time is desired, adjust DECEL RATE pot to decrease deceleration rate. Change speed control from maximum rapidly back to minimum several times and adjust DECEL RATE pot until desired deceleration rate is obtained.

NOTE

For best operation motor deceleration rate should be set just slightly slower than motor coast to stop rate or dynamic braking rate (when STOP or EMERGENCY STOP push button is pressed). This will assure deceleration under rate control.

L. Press and hold JOG push button. Adjust JOG pot to give desired JOG speed.

M. The factory setting of IR COMP pot is normally adequate. If adjustment is required, adjust as described in steps (1) thru (5) below.

1. Run motor at no load and 100% speed.

Table 2.10. Function of Pots on High Horsepower Main Interface PCB (400 thru 1000HP)

REFERENCE DESIGNATOR	CONTROL NAME	FUNCTION
1RH *	MAX RIPPLE	Factory set. Do not adjust.
2RH	MOTOR RIPPLE TRIP	Sets the maximum allowable output current ripple before the drive is tripped off of the line.

* On -0020 board (for parallel bridges) only.

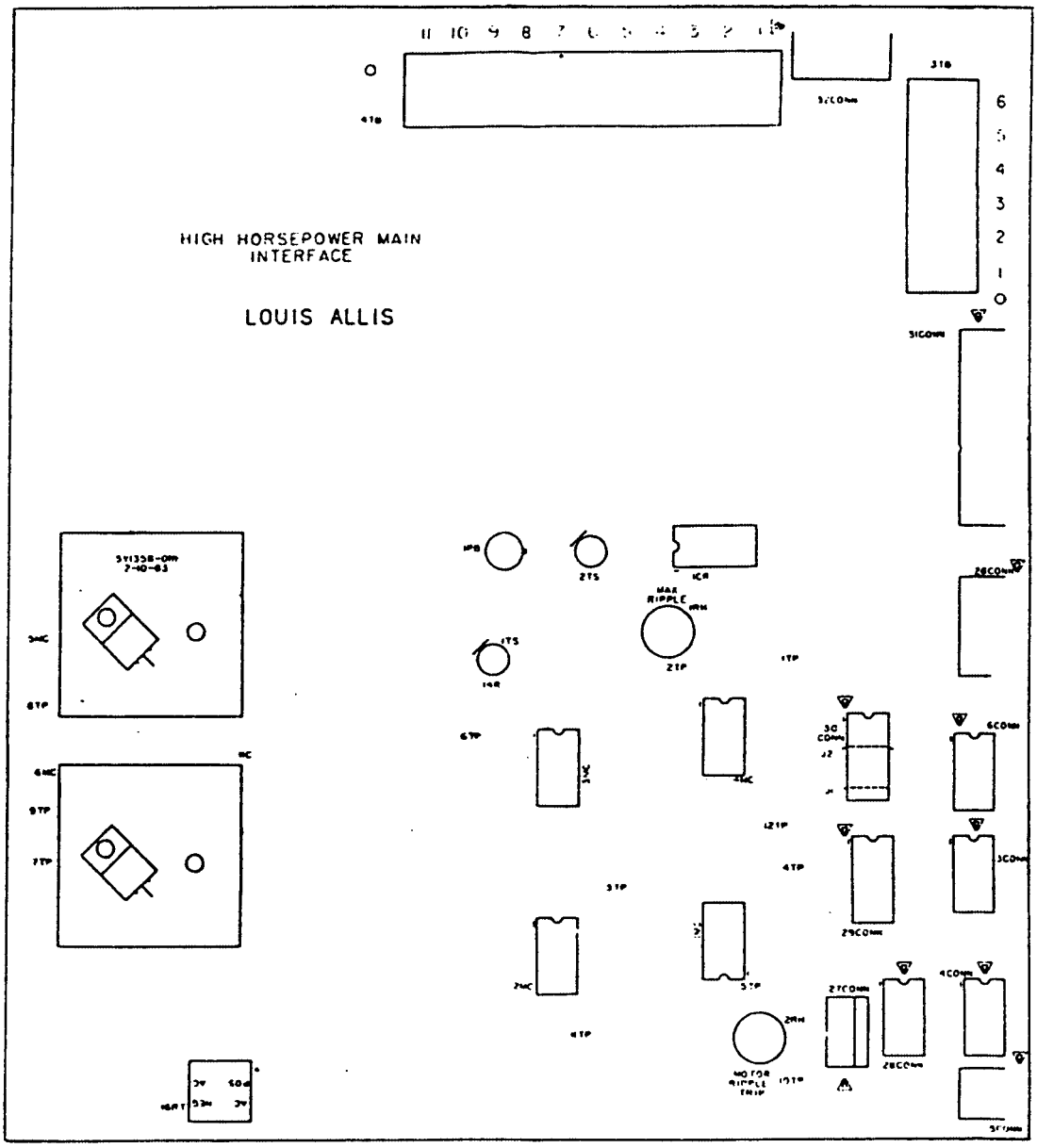


Figure 2.9. High HP Main Interface PCB

2. Measure exact motor speed and write motor speed here _____.

3. Stop drive and apply the desired working load.

4. Start drive (with SPEED still at 100%), and measure motor speed. Write motor speed here _____.

5. Adjust IR COMP to attain a loaded motor speed (step 4) 0.5% lower than the no load motor speed recorded in step 2.

N. Motor Ripple Current Trip Adjustment (400 thru 1000HP)

1. REMOVE INPUT POWER. Disconnect motor field leads at Controller. Turn the CURRENT GAIN pot totally CCW.

2. Disable the Field Loss Protection circuit by installing a jumper between its terminals 1TB-2 and 1TB-3. The field loss LED will be illuminated during this adjustment procedure.

3. Lock the motor shaft. The motor shaft may be considered locked if it is connected to a high friction load. If the motor is uncoupled or if the friction is negligible, place a suitable locking device on the shaft.

CAUTION

DO NOT ALLOW POWER TO BE APPLIED OVER AN EXTENDED PERIOD OF TIME WITH THE MOTOR SHAFT LOCKED. HIGH CONCENTRATION OF CURRENTS IN THE COMMUTATOR MAY CAUSE BURNING OF THE COMMUTATOR AND DETERIORATION OF THE BRUSHES. THIRTY (30) SECONDS SHOULD BE ADEQUATE TIME TO MAKE EACH ADJUSTMENT. A COOLING OFF TIME OF APPROXIMATELY TEN (10) MINUTES SHOULD BE ALLOWED AFTER EACH 30 SECONDS OF ON TIME.

4. Connect an oscilloscope between terminals 10TP (current feedback) and 33TP (common on the Voltage/Speed Main board. Adjust oscilloscope as follows:

VERTICAL ..... 1 v/cm (x 1 probe)
TIME BASE ..... 2 ms/cm

5. Connect a DC voltmeter between 3TP and common (7TP) on High HP Main Interface PCB.

6. Turn MOTOR RIPPLE TRIP pot on High HP Main Interface board to 100%.

7. Turn the CURRENT LIMIT pot fully counterclockwise to zero.

8. With 8SS set to OFF, connect a jumper from 34TP (-10I) to 8TP (current ref.) on Voltage/Speed Main PCB.

9. Apply power and press the RUN push button.

10. Carefully adjust the CURRENT LIMIT pot clockwise while observing the waveform on the oscilloscope until it looks like Figure 2.10.

(5 to 20% output current, slightly above 0 volts)

Figure 2.10. Current Reference

IMPORTANT

If the waveform looks like Figure 2.11 IMMEDIATELY DISCONTINUE this procedure because a malfunction exists within the drive. Turn off input power, reconnect the motor field leads, remove the jumper from the Field Loss Protection circuit, and perform Troubleshooting Procedure G.

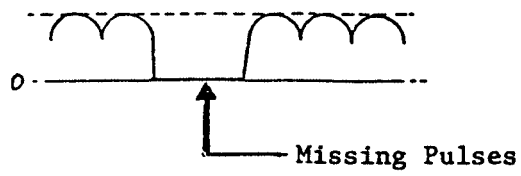


Figure 2.11. Current Reference (Malfunction)

11. Observe and record the voltage on DC voltmeter connected in step 5. _____ VDC.

12. Slowly adjust MOTOR RIPPLE TRIP pot (2RH) until the absolute value at 10TP on High HP Main Interface PCB is 25% greater than that of 3TP recorded in step 11.

13. Turn off power, remove the jumpers installed in step 2 and 8, reconnect motor field leads and unlock motor shaft if necessary. Set 8SS to ON.

0. The factory setting of CURRENT GAIN is normally adequate. If the drive application requires different gain adjustment (i.e., instability of the current regulator causes jittery 360 Hz sound in the Controllers or motor), perform the following steps:

1. DISCONNECT INPUT POWER. Disconnect motor field leads at Controller.

2. (200 thru 1000HP) Disable the Field Loss Protection circuit by installing a jumper between its terminals 1TB-2 and 1TB-3. The field loss LED will be illuminated during this adjustment procedure.

3. Lock the motor shaft. The motor shaft may be considered locked if it is connected to a high friction load. If the motor is uncoupled or if the friction is negligible, place a suitable locking device on the shaft.

CAUTION

DO NOT ALLOW POWER TO BE APPLIED OVER AN EXTENDED PERIOD OF TIME WITH THE MOTOR SHAFT LOCKED. HIGH CONCENTRATION OF CURRENTS IN THE COMMUTATOR MAY CAUSE BURNING OF THE COMMUTATOR AND DETERIORATION OF THE BRUSHES. THIRTY (30) SECONDS SHOULD BE ADEQUATE TIME TO MAKE EACH ADJUSTMENT. A COOLING OFF TIME OF APPROXIMATELY TEN (10) MINUTES SHOULD BE ALLOWED AFTER EACH 30 SECONDS OF ON TIME.

4. Connect DC voltmeter to Controller output (i.e., armature voltage) terminals.

5. With 8SS set to OFF, connect a jumper from 34TP (-10V) to 8TP (current reference) on Volt/Speed Main PCB.

6. Turn CURRENT LIMIT pot fully counterclockwise to zero.

NOTE

If an oscilloscope is available, skip steps 7 thru 9 and perform steps 10 and 11. If an oscilloscope is not available, perform steps 7 thru 9 and 11.

7. Apply power. Press RUN push button and adjust CURRENT LIMIT pot until voltmeter measures 5% of rated armature voltage.

8. Turn off power and reconnect DC voltmeter to 15TP (+) and 33TP (common) on Volt/Speed Main PCB.

9. With power on, turn CURRENT GAIN pot clockwise until volt meter begins to indicate fluctuating voltage, then back off 10%. Voltage should stabilize.

10. Connect an oscilloscope to 10TP (current feedback) and 33TP (common). Adjust scope settings as follows:

VERTICAL ..... 1 v/cm (x 1 probe)
TIME BASE ..... 2 ms/cm

With power on, turn CURRENT GAIN pot clockwise until waveform begins to show uneven pulses as in Figure 2.12, then back off 15%. A correct stable waveform should look like Figure 2.13.

Figure 2.12. Current Feedback (Unstable)

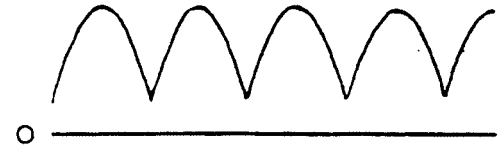


Figure 2.13. Current Feedback (Stable)

11. Turn off power, remove jumper, set 8SS to ON, reconnect motor field leads and unlock motor shaft.

P. Apply incoming 3Ø, 50/60 Hz power to Controller.

1. Note green READY lamp is on and all red lamps are off.

2. Note meter connected in step A reads -3.75V, or Test Meter (if available) at position 15 reads -3.75V.

This verifies that current limit is set for 150%. If reading is incorrect, adjust 3RH to obtain -3.75V. The factory setting of CURRENT LIMIT (at 150%) is normally adequate (with burden resistor 2R or 27CONN properly selected). If the drive application requires a different current lirit, set up to measure voltage as in steps A and B, apply power, and adjust CURRENT LIMIT until the test point measures the voltage equivalent to the desired limit. The voltage and current limit have a linear relationship, as shown in Figure 2.14 and listing of sample value.

Voltage = -2.50V x desired current limit.

-5.00V for 200% (max.)
-3.75V for 150%
-2.50V for 100%
-1.25V for 50%

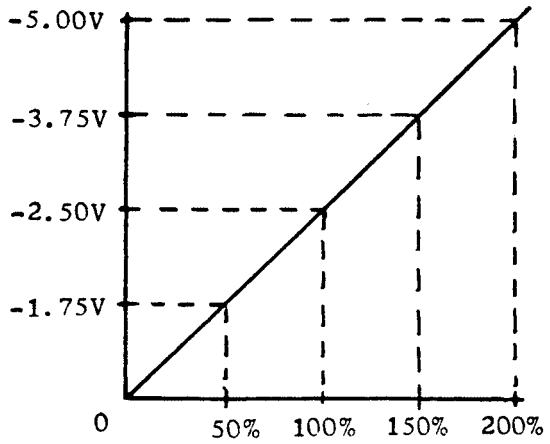


Figure 2.14. Current Limit

2.10 START/STOP INSTRUCTIONS FOR NORMAL OPERATION

TO START DRIVE:

1. Apply power to Controller.

2. Press RUN push button.

3. Advance SPEED control to attain desired motor speed.

TO STOP DRIVE:

1. Press STOP push button.

2. Shut off power to Controller.

SECTION 3. THEORY OF OPERATION

3.1 DRIVE OPERATION

The typical DC Static Drive (Figure 3.1) consists of a DC Shunt Wound Motor (tachometer optional), power bridge hardware, signal level electronics and start/stop relay logic. The signal level electronics provides for proper motor speed regulation via a motor armature voltage regulator or an optional speed regulator (tachometer feedback). The run command is push-button controlled and, if the signal level electronics has not detected any fault conditions, the drive motor will accelerate to the set speed.

3.2 PROTECTIVE CIRCUITRY

The Controller contains protective circuitry and components which, when taken together, assure excellent protection to the drive system and the power lines. This protective circuitry includes:

A. Power line fuses.

B. Motor armature loop contactor capable of breaking full load current.

C. Electronic overload relay: completely static.

D. Instantaneous Static Trip (IST).

E. Isolation of control circuitry.

F. Phase sequence insensitive.

G. Phase Loss

H. Undervoltage: designed to stop drive if AC voltage drops to 80% of rated.

I. Transient suppression provided by line reactors, RC snubbers, and MOVs.

J. Current limit adjustable from 10% to 200% of full load motor current.

K. Overtemperature: thermostat mounted directly on thyristor heatsink.

3.3 POWER SUPPLY

The Power Supply PCB receives 36V center-tapped input from a transformer within the Controller chassis. From this input, it produces outputs of ±24VDC (unregulated) and ±15VDC (regulated), which are fed to the Voltage/Speed Main PCB for distribution to the signal level electronics.

3.4 POWER BRIDGE SECTION

The power bridge performs two major functions; it converts AC voltage to DC voltage by rectification of the three-phase AC waveform, and it varies the amplitude of DC voltage by controlling the portion of the three-phase AC waveform which is passed. It is the nature of an SCR (silicon controlled rectifier) that it will conduct current in one direction only (DC), and that it will not conduct at all until it is turned on (fired) by a gating pulse. By using these two characteristics, it is possible to obtain amplitude controlled DC voltage from an AC line.

To simplify the concepts of rectification and amplitude control, a representation of the voltage from phase A to phase C is shown in Figure 3.2. Because of the fact that an SCR will conduct current in only one direction, only the portion of the sine wave above the line can supply power to the load (Figure 3.2a). The fact that an SCR will not conduct at all until it is turned on allows us to vary the resulting DC voltage amplitude. A larger average voltage will result if the SCR is fired at point (A) than at point (B) (Figure 3.2b).

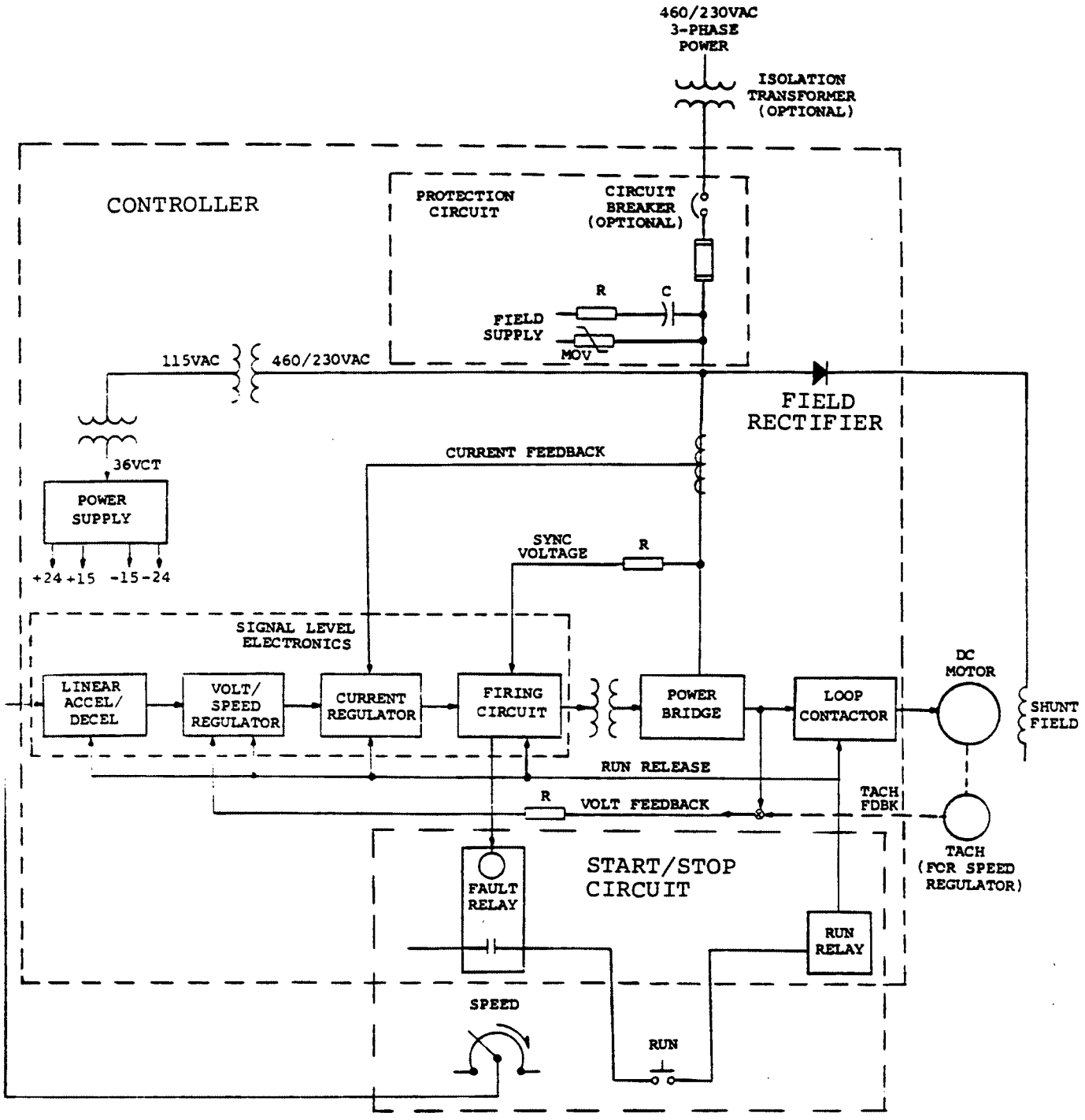
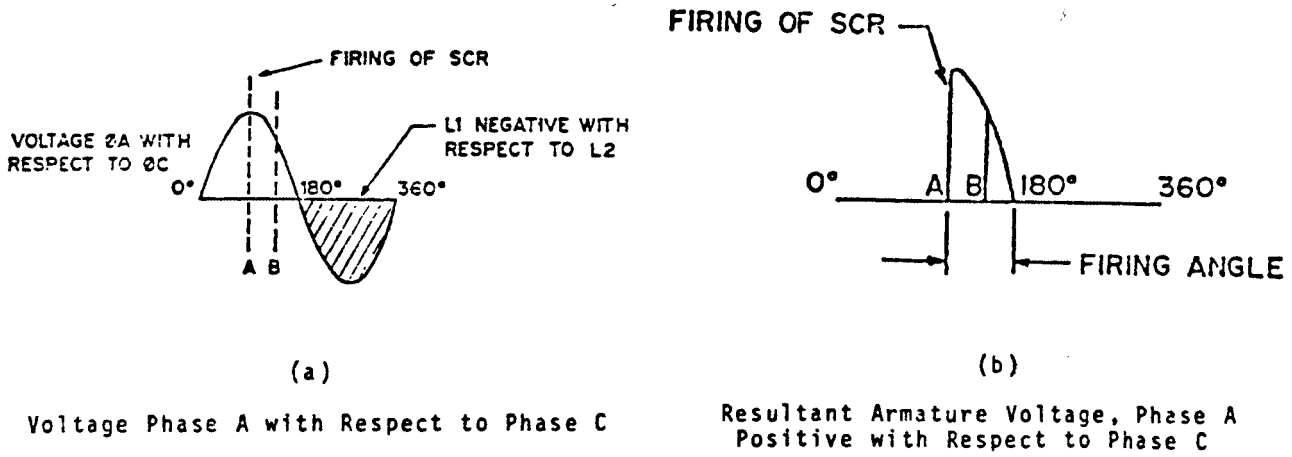


Figure 3.1. 6SCR DC Drive System



(a)

Voltage Phase A with Respect to Phase C

(b)

Resultant Armature Voltage, Phase A Positive with Respect to Phase C

Figure 3.2. Phase Control Firing

The three-phase full wave bridge is made up of six SCRs which are fired (gated) two at a time. In this way, each phase of the AC line is connected, one at a time, to the DC motor armature. With AC input phases designated A, B, and C and SCRs designated one through six, the sequence of firing is shown in the following chart:

PHASE	SCRs FIRED
A to B	1 and 6
A to C	1 and 2
B to C	3 and 2
B to A	3 and 4
C to A	5 and 4
C to B	5 and 6

In order to establish current flow in the armature, the AC voltage must be at a higher potential than the motor CEMF at the time the SCR is gated. It is inherent to the operation of an SCR, as previously mentioned, that a forward voltage bias (anode to cathode) is necessary before conduction can occur. The motor CEMF presents a reverse bias to the SCR. Once conduction begins, the armature current flow is sustained through the point where the AC applied voltage equals the CEMF and continues to flow until forced to zero by the reverse voltage applied to the inductive armature circuit.

The conduction interval, as shown in Figure 3.3, consists of 60 electrical degrees for each pair of SCRs. Therefore, different SCR pairs are fired at equal intervals six times every 360°.

The three-phase AC line voltage and a three-phase full wave bridge are shown in Figure 3.3. Here, the timing of gating pulses to achieve maximum output voltage is also shown.

3.5 SIGNAL LEVEL ELECTRONICS

A. Firing Circuit

The firing circuit is phase insensitive (does not care if power line rotation is ABC or CBA) and generates SCR triggering pulses for the Power Bridge SCRs. Major input are power line synchronizing information, current error signal from current regulator and RUN ENABLE from relay logic. Major outputs are fully formed SCR gating signals for each of

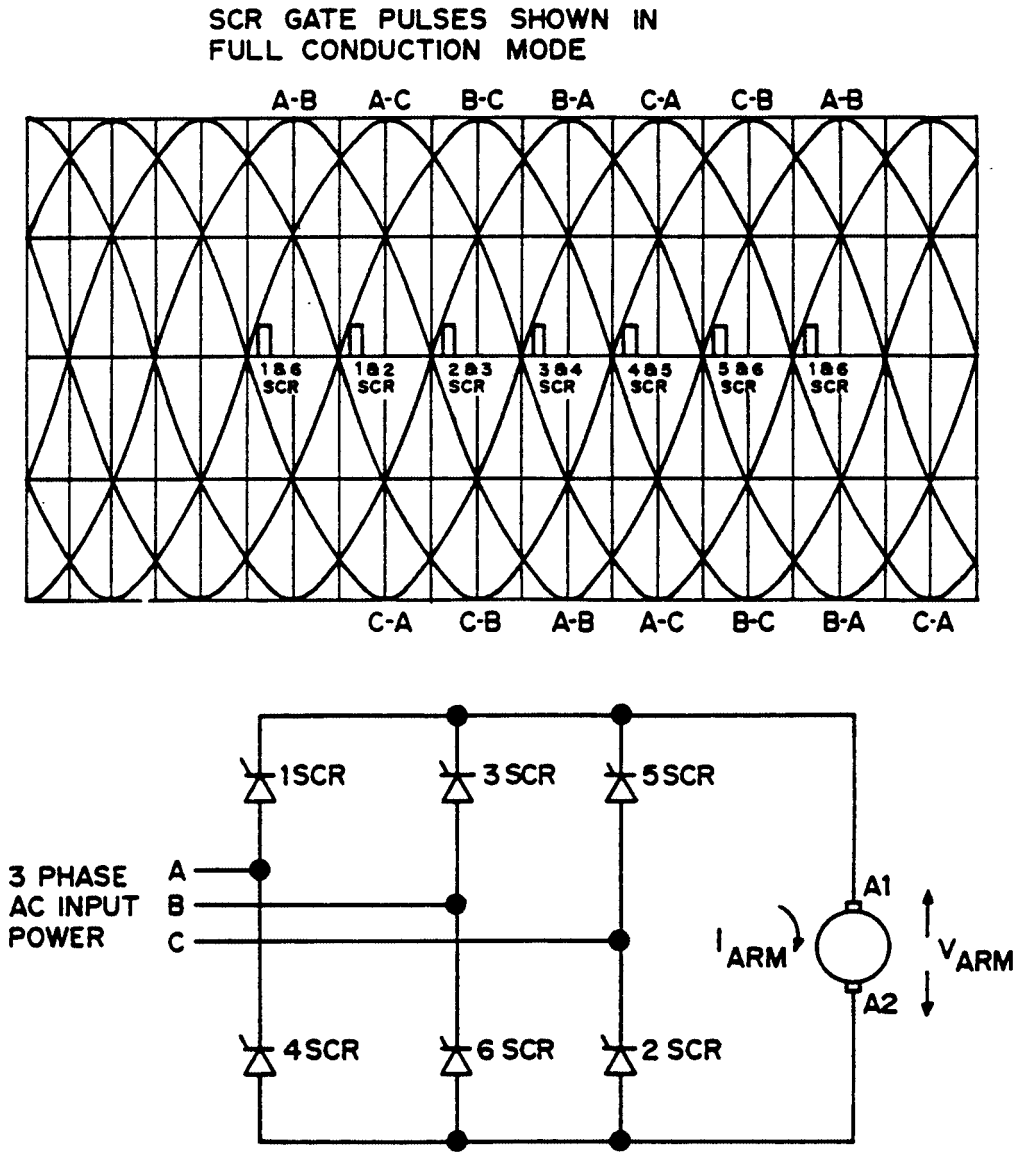


Figure 3.3. SCR Gate Pulses, AC Line Waveforms & 6SCR Power Bridge

the six SCRs and a fault relay driver which will enable proper shutdown sequence in case of the following faults.

1. Instantaneous Static Trip (IST) over 310% motor current.

2. Low line voltage (less than 80%).

3. Inverse time overload.

4. Auxiliary Trip (for special applications only).

The firing circuit is activated when the Main Contactor is energized.

B. Current Regulator

The current regulator compares the current reference (voltage or speed error) with the current feedback signal and determines the proper firing angle command for the firing circuit. The current feedback signal is derived from the three-phase AC lines by current transformers (mounted under line fuses) and burden resistors (mounted on the Potentiometer PCB). The current regulator is provided with a gain adjustment to correct for variations in motor parameters. The presence of the current regulator allows for rapid and precise control of armature current at all times, regardless of line fluctuations. The current regulator reference utilizes an adjustable (0 to 200%) current limiting amplifier to provide accurate adjustable current limit. The current regulator is activated when the Main Contactor is energized.

C. Voltage/Speed Regulator

The voltage/speed regulator compares the desired speed reference (either the speed command signal or the linear accel/decel signal) with either a scaled bridge voltage (if used as a voltage regulator) or a scaled tach signal (if used as a speed regulator). The use of this comparator as a speed regulator requires the addition of the Speed Regulator plug-in option. The standard voltage regulator provides for speed droop caused by motor loading by boosting the speed command through use of an adjustable IR COMP circuit. The voltage/speed regulator is activated when the Main Contactor is energized.

D. Linear Accel/Decel

The separately adjustable linear accel/decel control assures that motor speed changes (acceleration and deceleration)occur at a constant, pre-adjusted rate. Acceleration and deceleration of the motor speed take place at a constant rate. Two ranges of adjustment are provided, 1-7 seconds and 7-40 seconds. Because the Saber 3306 is a non-regenerative drive, deceleration time must be set longer than the coast-to-stop, if control of deceleration is required. The linear accel/decel amplifier is activated when the Main Contactor is energized.

SECTION 4. MAINTENANCE

4.1 PREVENTIVE MAINTENANCE

WARNING

DO NOT PERFORM PREVENTIVE MAINTENANCE WITHOUT FIRST ENSURING ALL INPUT POWER HAS BEEN REMOVED.

Only qualified maintenance personnel trained to work with high voltage power circuitry and low voltage semiconductor circuitry are allowed access to the power section.

Preventive maintenance is primarily a matter of routine inspection and cleaning. The rectifier bridge heatsinks should be kept clean by brushing while using a vacuum cleaner. Excess dust and dirt accumulation on the heatsinks can cause overheating of the SCRs. Fuse contacts must be inspected for corrosion.

The door filters should be replaced approximately every month depending on operating conditions.

Periodically clean the cooling fan to prevent dirt buildup. At the same time, check that the impellers are free and not binding in the housing. The fans on the 200 to 800HP Controller are permanently lubricated and should be replaced if the shaft does not spin freely.

4.2 REPAIR AND REPLACEMENT PROCEDURES

WARNING

DO NOT ATTEMPT REPAIR OR PART REPLACEMENT WITHOUT FIRST ENSURING ALL INPUT POWER HAS BEEN REMOVED.

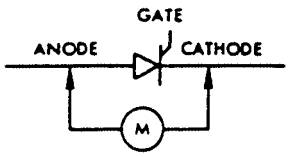
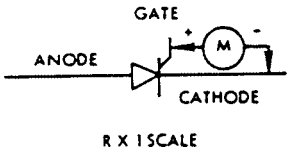
4.2.1 Printed Circuit Boards

Repair of printed circuit boards requires special techniques and test facilities. For this reason, field repair is not authorized and replacement of a suspect board is recommended.

Defective or questionable printed circuit boards should be returned to MagneTek, Louis Allis Drives & Systems Division, Service Department, 16555 W. Ryerson Road, New Berlin, Wisconsin 53151, for repair and test. The printed circuit board should be individually protected with one-inch thickness of soft wrapping material before it is packed in a suitable carton. Louis Allis Drives & Systems Division assumes no responsibility for printed circuit boards returned without proper return tags and forms. Contact the nearest Louis Allis District Office for proper return tags and forms.

Repaired or replacement printed circuit boards are tested and adjusted using factory facilities. Settings normally will not require readjustment.

Table 4.1. SCR Testing

TEST CONNECTION	METER READINGS	SCR CONDITION
(1) 	"HOCKEY PUK" type greater than 20K 2K-20K less than 20K	 ACCEPTABLE QUESTIONABLE SHORTED
	MODULAR type greater than 1.7M less than 1.7M	 ACCEPTABLE SHORTED
(2) 	"HOCKEY PUK" type 5-100 OHMS 100 OHMS - 1K less than 5 OHMS greater than 1K	 ACCEPTABLE QUESTIONABLE SHORTED OPEN
	MODULAR type 10-130 OHMS less than 10 OHMS greater than 130 OHMS	 ACCEPTABLE QUESTIONABLE (POSSIBLE SHORT) OPEN

4.3 SCRs

The power bridge contains either one of two types of SCRs (thyristors), depending on the horsepower rating. Units up to 60HP 500V or 30HP 240V have modular type SCRs, with each module containing two SCRs. Units rated higher have individual "Hockey Puk" type SCRS.

WARNING - HIGH VOLTAGE

PERSONNEL WILL BE EXPOSED TO HIGH VOLTAGE WHEN THE CONTROLLER IS OPENED. ELECTRICAL SHOCK CAN CAUSE SERIOUS OR FATAL INJURY. REMOVE AC INPUT POWER BEFORE ATTEMPTING TO PERFORM ANY MAINTENANCE FUNCTION ON THE POWER BRIDGE.

SCRs may be tested by using the following procedures to check for shorts or open circuits. When readings fall outside the acceptable range, DO NOT REPLACE AN SCR UNTIL A COMPARISON IS MADE WITH OTHER SCRs IN THE RECTIFIER BRIDGE. Always use the same ohmmeter when performing comparison tests.

4.3.1 Modular Type

A. Disassembly of SCR Bridge

In order to test or replace modular SCRs, the bridge must first be disassembled as follows (see Figure 4.1).

1. Remove three metric nuts which secure the AC leads to the modules. Then lift the AC leads and red cathode leads off of the terminal studs.

2. Remove three metric nuts from terminal studs for the +DC bus, then lift the +DC lead, the red cathode leads and the red +DC feedback lead off of the terminal studs. Remove the bus bar and insulator.

3. Remove three metric nuts from terminal studs for the -DC bus, then lift the -DC lead and red -DC feedback lead off of the terminal studs. Remove the bus bar and insulator.

4. Disconnect two white gate leads for each module from faston tabs on Pulse Transformer/Voltage Sense PCB.

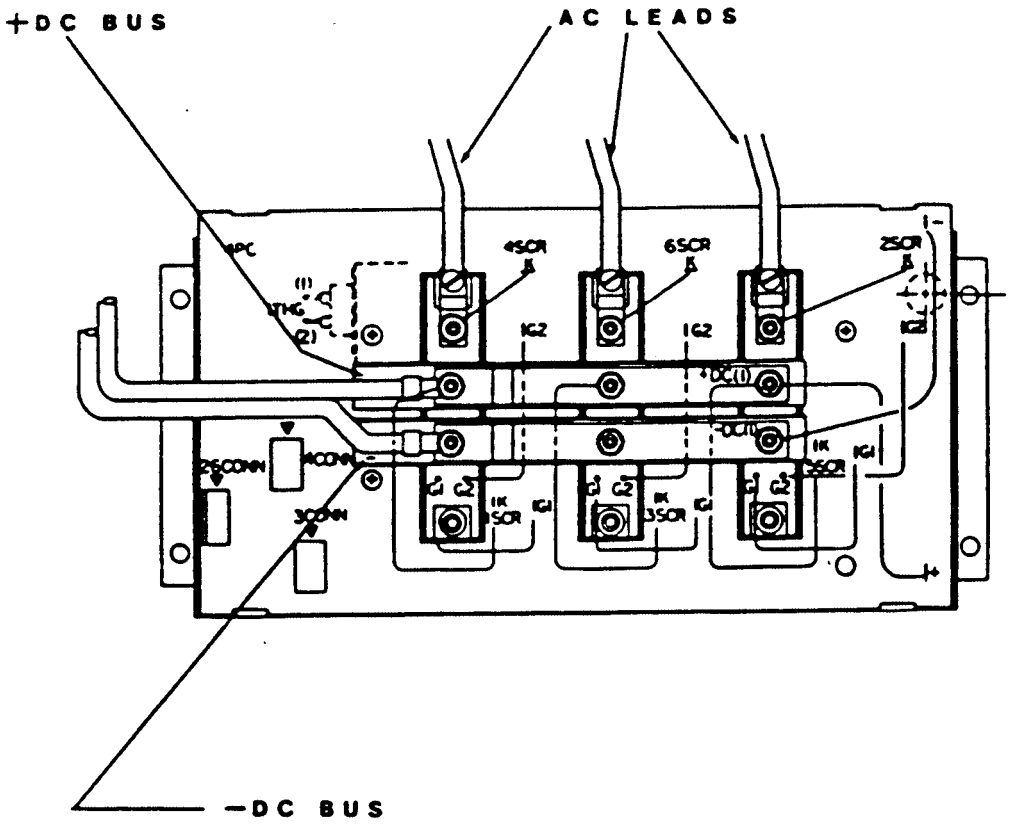


Figure 4.1. Modular Type 6SCR Bridge
5 thru 30 HP 240V; 7.5 thru 60 HP 500V

B. Testing - Check SCRs without removing from the heat sink.

1. Using an ohmmeter in the x10K range, place the positive probe on SCR1 anode (A1), and the negative probe on SCR1 cathode (K1), shown in Figure 4.1. Compare your reading with Section 1 of Table 4.1. After checking SCR1, check SCR2 by placing the positive probe on SCR2 anode (A2) and the negative probe on SCR2 cathode (K2), shown in Figure 4.2. Compare your reading with Section 1 of Table 4.1.

2. Place the positive probe of the ohmmeter on SCR1 cathode (K1), and the negative probe on SCR1 anode (A1). Compare your reading with Section 1 of Table 4.1. After checking SCR1, check SCR2 by placing the positive probe on SCR2 cathode (K2) and the negative probe on SCR2 anode (A2). Compare your reading with Section 1 of Table 4.1.

3. Using an ohmmeter in the X1 range, check gate resistance of SCR1 by placing the positive probe on gate terminal G1 of the SCR module, shown in Figure 4.2 and the negative probe on SCR1 cathode connection K1. Compare your reading with Section 2 of Table 4.1. After checking SCR1, check SCR2 by placing the positive probe on gate terminal G2 of the SCR module, and the negative probe on SCR2 cathode connection K2. Compare your reading with Section 2 of Table 4.1.

C. Removal and Installation. The module type SCRs are mounted to the Rectifier Bridge heat sink through openings in the Pulse Transformer/ Voltage Sense PCB. It is not necessary to remove the PCB when replacing SCR modules.

Using an Allen wrench or key, remove the two socket-head screws, with Belleville washers (and flat washers, if present), holding the SCR module to the heat sink, and gently pull the module from its position.

See Figure 4.2.1. Examine the new module to determine number of washers (Belleville and flat) required under each socket-head screw. If the module has a plastic housing, a flat washer of appropriate size should be under the Belleville washer(s). Modules that have a brass eyelet in the mounting hole must also have a flat washer installed. If the module has metal inserts for the Belleville washers to "seat" on, do not use the flat washer.

Apply a thin, even coating of thermal joint compound (NOT Pentrox A) to the entire bottom (mounting surface) of the module. Position the module on the heat sink and loosely install the mounting hardware.

IMPORTANT

DO NOT use a torque wrench to tighten the hardware. The correctly flattened Belleville washer (as described below) provides the proper mounting pressure.

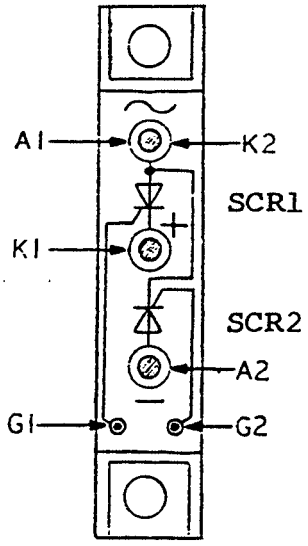
Start by tightening both screws equally (alternately) with an Allen wrench or hex key. Finish with this procedure until the Belleville washers are flat. An abrupt change in torque will be detected when the Belleville becomes flat.

Wipe off any excess thermal joint compound from module/heat sink assembly.

Remove the three terminal studs from the replaced module and install them into threaded terminals of the new module.

D. Reassembly of SCR Bridge. After testing or replacement of SCRs, reassemble the bridge as follows (see Figure 4.1.).

1. Connect white gate leads from SCR modules to faston tabs on Pulse Transformer/Voltage Sense PCB.



NOTE
Symbols are marked on SCR module.

Figure 4.2 SCR Module Test Points

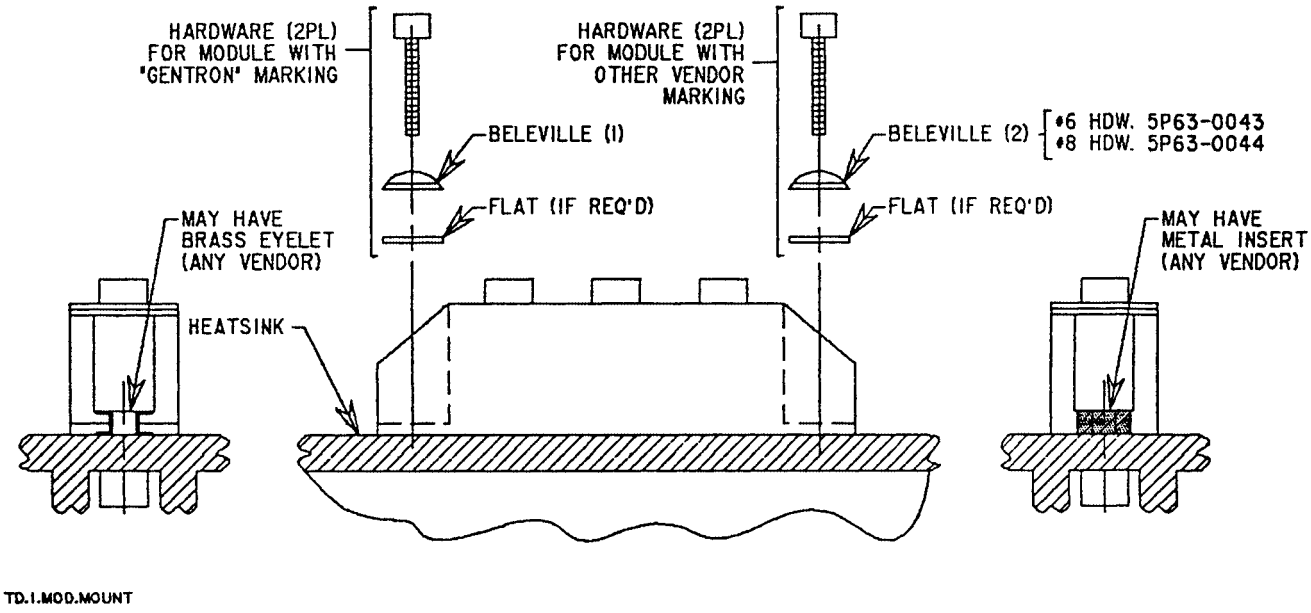


Figure 4.2.1 Module Mounting Combinations

THIS PAGE INTENTIONALLY LEFT BLANK

2. Position insulator and -DC bus bar across bottom three terminal studs. Position -DC lead and red -DC feedback lead. Install three metric nuts and torque to 26 inch-pounds.

3. Position insulator and +DC bus bar across center three terminal studs. Position red cathode leads, +DC lead and +DC feedback lead. Install three metric nuts and torque to 26 inch-pounds.

4. Position red cathode lead and AC lead to the top terminal stud on each module. Install the 8MM metric nut on each terminal stud and torque to 26 inch-pounds.

4.3.2 "Hockey Puk" Type (Ref. Figure 4.2 thru 4.5)

A. Testing. The "Hockey Puk" type of SCRs must be properly secured in their heat sinks in order to be effectively tested with an ohmmeter. The proper pressure must be applied to the poles of these SCRs to provide continuity. Check SCRs as follows without removing them from the rectifier bridge. Readings are valid only when the SCR has been isolated from other circuit connections; therefore, before continuing the AC leads must be disconnected from the bridge and the SCR gate leads disconnected from the Pulse Transformer/Voltage Sense PCB.

NOTE

The "Hockey Puk" type SCR has no anode lead. Ohmmeter probe must be placed on the heat sink to which the SCR anode makes contact. The red wire from the SCR is the cathode lead.

1. Using a multimeter on the x100 ohm range, place the POSITIVE (+) probe on the heat sink to which the SCR anode makes contact, and the NEGATIVE (-) probe to the SCR cathode lead (red wire). Compare the ohmmeter reading with Section 1 of Table 4.1.

2. Reverse multimeter leads connected in Step 1. Compare the ohmmeter reading with Section 1 of Table 4.1.

3. Check the gate resistance of the SCRs by setting the ohmmeter range to x1 and connecting the ohmmeter positive probe to the SCR gate lead (white wire) and the negative probe to the cathode lead (red wire). Compare the ohmmeter reading with Section 2 of Table 4.1.

B. Removal and Installation

1. Disconnect the external wiring from the Pulse Transformer/Voltage Sense PCB (3CONN, 4CONN, 26CONN, all SCR leads and "+" and "-"). Then remove the PCB from retaining clips.

2. Disconnect the AC lead from the heat sink section containing the SCR to be replaced, and remove the two bolts securing the heat sink section to the bridge assembly bus bars.

NOTE

If the heat sink section being removed contains the bridge thermoguard, its connector (15CONN) must also be removed from the Relay/Interface PCB.

Lift the heat sink section out of the Controller chassis.

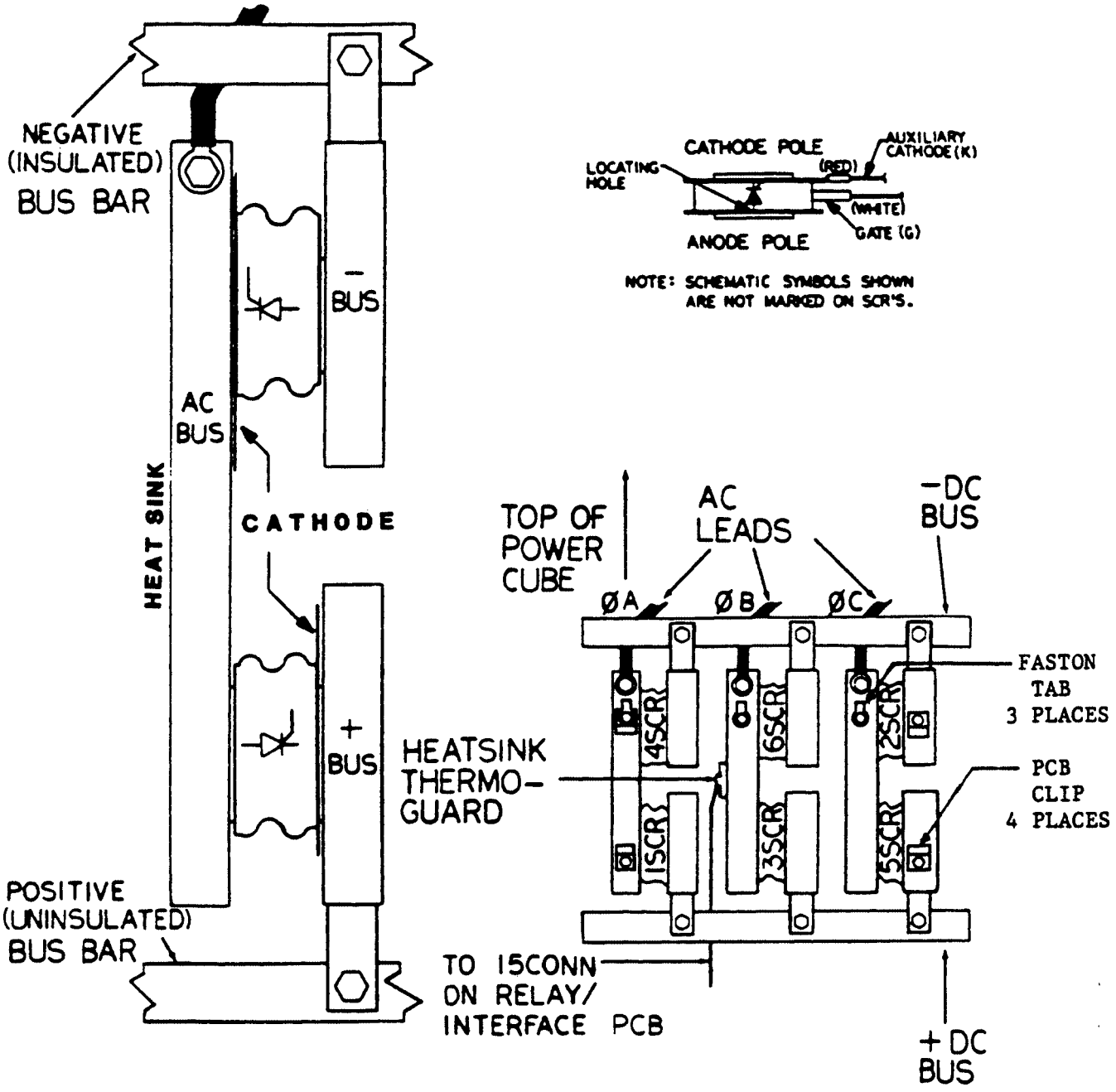


Figure 4.3. "Hockey Puk" Type 6SCR Bridge
40 thru 75 HP 240V, 75 thru 200 HP 500V, 53SD

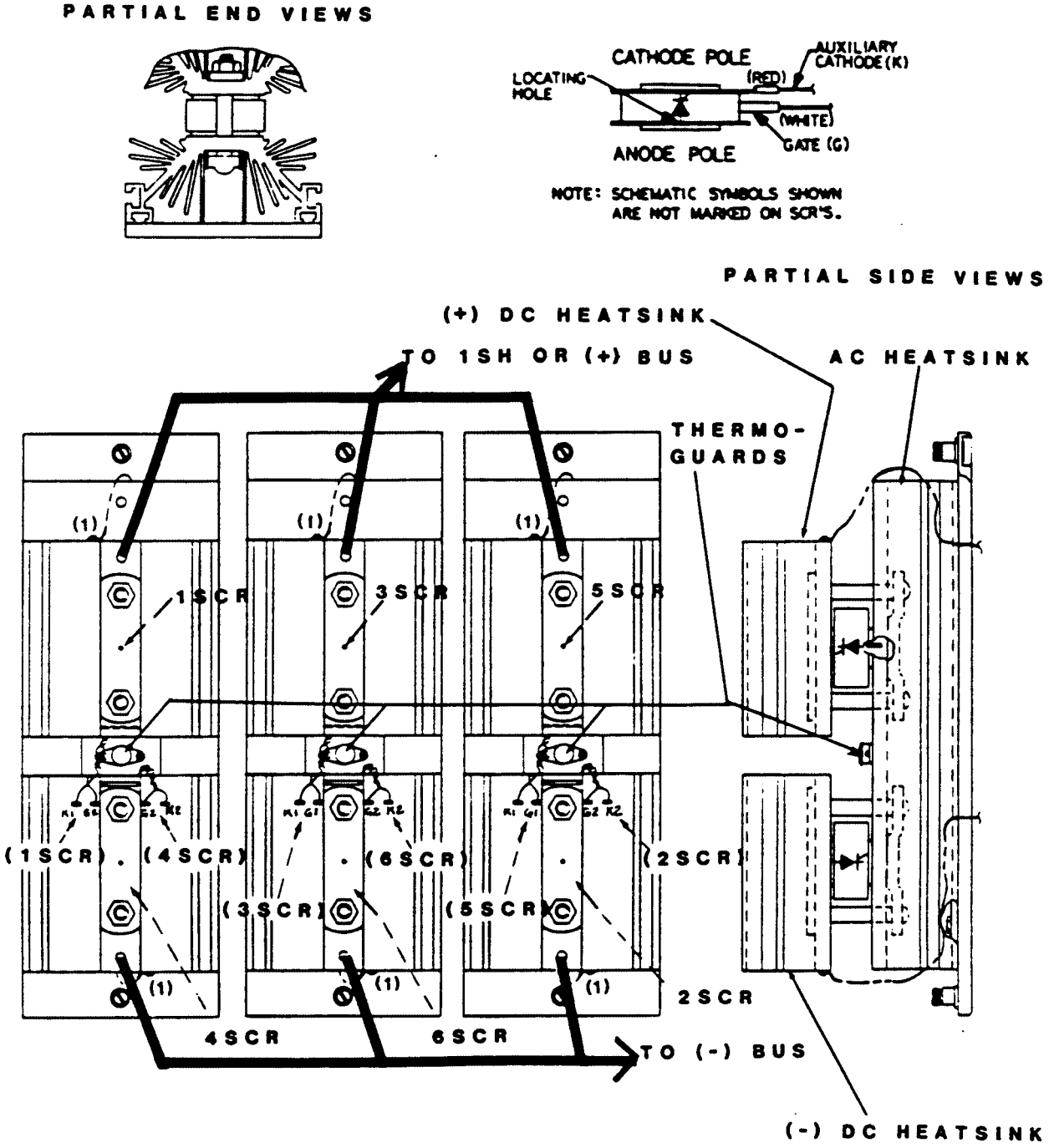


FIGURE 4.4 "HOCKEY PUK" TYPE 6SCR BRIDGE
200 THRU 300HP 500V, 53SK

THIS PAGE INTENTIONALLY LEFT BLANK

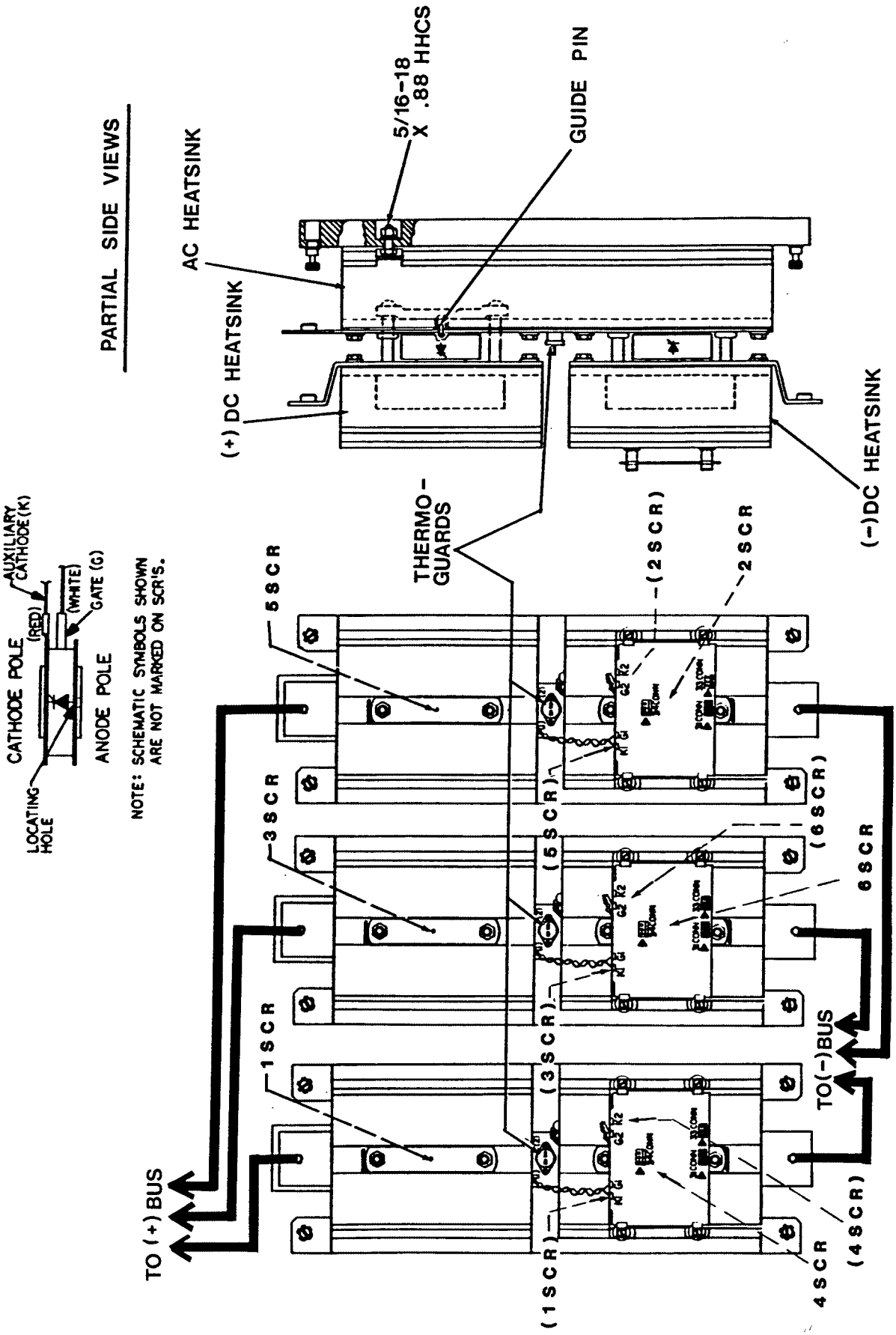


FIGURE 4.4A "HOCKEY PUK" TYPE 6SCR BRIDGE 400 THRU 800HP 500V

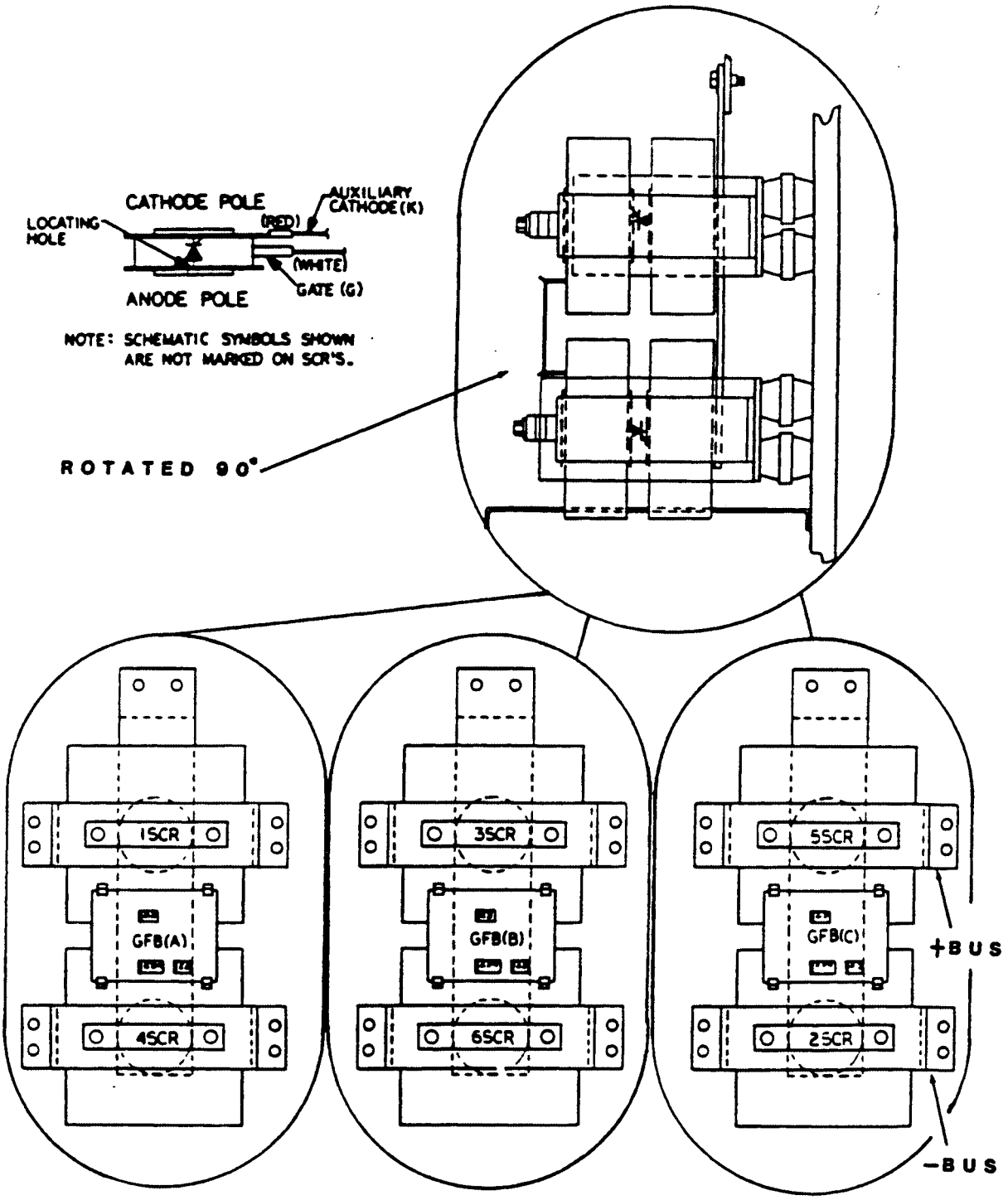


FIGURE 4.5 "HOCKEY PUK" TYPE
6SCR BRIDGE 900 THRU 1000HP 500V

B. Removal and Installation (cont'd)

3. Loosen the two nuts on the gauge clamp until SCR can be removed from the heat sink.

4. Be sure the contact surfaces of the heat sink and the new SCR are clean. To ensure adequate heat transfer, apply a light coating (2 or 3 drops) of silicone fluid (GE SF-1154 or equivalent) on the contact surfaces. Insert the SCR so the terminals extend from the heat sink assembly, on the same side as the bus bar connectors. Position the SCR so the hole on one side engages a locating pin on the heat sink.

5. Before clamping the heat sinks, be sure the ends and sides of the heat sinks are parallel. Press the heat sinks firmly against the SCR to ensure complete surface contact. Turn nuts evenly onto the studs by hand. Tighten the nuts alternately 1/4 turn at a time until the gauge indicates a deflection of 1.0.

6. After SCR has been installed, replace heat sink section in bridge assembly. Replace Pulse Transformer/ Voltage Sense PCB, and re-connect all wiring.

NOTE

When replacing gate leads from SCR to Pulse Transformer/Voltage Sense PCB, do not push too hard on the PCB or the board may be damaged.

Before applying voltage:

1. Ensure all terminal nuts have been torqued correctly.

2. Check positive and negative bus bars for shorts.

3. Check AC lines for shorts.

4.4 SPARE/REPLACEMENT PARTS

Spare/replacement parts for the standard Saber 3306 6SCR Controllers may be ordered one of two ways.

A. 5 thru 200HP.

Table 4.2 lists spare parts kits which may be ordered, according to drive HP and input voltage.

Each kit contains the most essential parts for good spare parts protection and is ideal for start-up spares.

A complete set of recommended spare parts consists of one each of a, b and c.

B. 5 thru 200HP and 200 thru 1000HP.

Tables 4.3 and 4.4 list spare parts individually according to drive HP and input voltage.

Custome designed orders (see page 1-4) may require special parts other than those listed in Table 4.2 thru 4.4. When ordering spare parts for this type drive, specify the serial number stamped on the Controller nameplate. Contact the nearest Louis Allis District Office for parts ordering information.

Table 4.2 Spare Parts Kits

460 Volts AC

HP	Fuse Kit (a) Kit Number	SCR Kit (b) Kit Number	PCB Kit (c) Kit Number
7.5	P33040	P33041	P33049
10	P33040	P33041	P33049
15	P33040	P33042	P33049
20	P33040	P33042	P33049
25	P33040	P33043	P33049
30	P33040	P33043	P33049
40	P33040	P33044	P33049
50	P33040	P33044	P33049
60	P33040	P33045	P33049
75	P33040	P33046	P33050
100	P33040	P33046	P33050
125	P33040	P33047	P33050
150	P33040	P33048	P33050

230 Volts AC

HP	Fuse Kit (a) Kit Number	SCR Kit (b) Kit Number	PCB Kit (c) Kit Number
5	P33040	P33041	P33049
7.5	P33040	P33042	P33049
10	P33040	P33042	P33049
15	P33040	P33043	P33049
20	P33040	P33044	P33049
25	P33040	P33044	P33049
30	P33040	P33045	P33049
40	P33040	P33046	P33050
50	P33040	P33046	P33050
60	P33040	P33047	P33050
75	P33040	P33048	P33050

Description of kit contents:

(a) Control Fuse Kit:

Kit P33040 Contains:
- Four Control Fuses
- Eight PCB Fuses
- One Field Supply Rectifier

(b) Power Element Kit:

Kits P33041 - P33048 Contains:
- Six Thyristors
- Six Line Fuses

Kits P33041 thru P33045 - contain Qty. (3) doubler thyristors.

(c) PCB Kit:

Kits P33049 - P33050 Contains:

- One V/Speed Main PCB
- One Snubber PCB
- One Power Supply PCB
- One Pulse Transformer PCB
- One Relay/Interface PCB
- One Pot PCB

TABLE 4.3. SPARE PARTS LIST (5 thru 200HP; 53SD-REV 2)

DESCRIPTION		DRIVE HP	AC VOLTS	SYMBOL	PART NUMBER	Recommended Stock Quantity Based on Number of Identical Drives or Assemblies			
						1-4	5-9	10-25	26 or More
	35A	5	230						
	700V	7.5-10	460		05P00017-0226	6	12	18	24
LINE									
FUSES	50A	7.5-10	230						
	700V	15-20	460	1F	05P00017-0227	6	12	18	24
	70A	15	230						
	700V	25-30	460	2F	05P00017-0155	6	12	18	24
	125A	20-25	230						
	700V	40-50	460	3F	05P00017-0228	6	12	18	24
	150A	30	230						
	700V	60	460		05P00017-0166	6	12	18	24
	200A	40-50	230						
	700V	75-100	460		05P00017-0179	6	12	18	24
	400A	60-75	230						
	700V	125-200	460		05P00017-0222	6	12	18	24

Table 4.3 Spare Parts List (5 thru 200HP; 53SD REV 2) – Continued

DESCRIPTION		DRIVE HP	AC VOLTS	SYMBOL	PART NUMBER	Recommended Stock Quantity Based on Number of Identical Drives or Assemblies 1-4	5-9	10-25	26 or More
BLOWER MOTOR FUSES	.6A	7.5	230		05P00017-0202	6	12	18	24
	.6A	10-20	230		05P00017-0202	6	12	18	24
	1.6A	25-50	230		05P00017-0192	6	12	18	24
NOMINAL ONLY	5A	60-75	230	5F	05P00017-0203	6	12	18	24
	.3A	7.5-15	460	6F	05P00017-0195	6	12	18	24
CHECK ACTUAL NAME-PLATE RATING	.8A	20-50	460	7F	05P00017-0204	6	12	18	24
	2.5A	60	460		05P00017-0205	6	12	18	24
	2.5A	75-125	460		05P00017-0205	6	12	18	24
	1.8A	150	460		05P00017-0206	6	12	18	24
PANEL FUSE (for control XFMR, 2PT)	See Table 4.3A		2A 250V	4F	05P00017-0241	3	6	9	12
			3A 250V		05P00017-0003	3	6	9	12
PCB FUSE			3A 250V	8F	05P00017-0138	3	6	9	12
PCB FUSE			1A 250V	9F	05P00017-0230	3	6	9	12
FIELD SUPPLY RECTIFIER				1RT	05P00050-0298	1	1	2	2
MODULE TYPE THYRISTORS		5-10	230	1-6 SCR	05P00050-0311	6	6	9	12
		7.5-20	460						
		15	230		05P00050-0312	3	6	9	12
		25-30	460						
		20-30	230		05P00050-0313	3	6	9	12
		40-60	460						
HOCKEY "PUK" TYPE		40-60	230	1-6 SCR	05P00050-0163	6	12	18	24
		75-125	460						
		75	230		05P00050-0283	6	12	18	24
		150	460			6	12	18	24
		200	460						

Table 4.3 Spare Parts List (5 thru 200HP; 53SD-REV 2) - Continued

DESCRIPTION	DRIVE HP	AC VOLTS	SYMBOL	PART NUMBER	Recommended Stock Quantity Based on Number of Identical Drives or Assemblies 1-4	5-9	10-25	26 or More
AC R.C. SNUBBER PCB	5-30	230	1-3 PC	46S02265-0010	1	2	3	4
	7.5-60	460						
	40-75	230						
	75-200	460		46S02265-0020	1	2	3	4
FAN	5-150		1,2 MTR	05P00016-0027	0	0	1	1
	200			05P00016-0012	0	0	1	1
DC SNUBBER 2500 ohms 25W			4R	05P00041-0075	1	1	1	1
.25MFD			1C	05P00224-0079	1	1	1	1
POWER SUPPLY PCB			6PC	46S02263-0020	1	1	2	2
PULSE TRANSFORMER PCB			4PC	46S02264-0011**	1	1	1	2
RELAY/INTERFACE PCB			5PC	46S02274-0041	1	1	1	2
THREAD PCB			17PC	46S02275-0010	1	1	2	2
AUTO/MANUAL PCB			16PC	46S02276-0010	1	1	2	2
CONTROLLED STOP PCB			15PC	46S02277-0010	1	1	2	2
VOLT/SPEED MAIN PCB *			7PC	46S02266-0031	1	1	2	2
POTENTIOMETER PCB			8PC	46S02267-0020	1	1	2	2
SPEED REG. PCB			12PC	46S02268-0050	1	1	2	2
VOLT/CURRENT FOLLOWER PCB			9PC	46S02269-0010	1	1	2	2
PRECISION REFERENCE PCB			10PC	46S02270-0010	1	1	2	2
S-CURVE PCB			11PC	46S02271-0020	1	1	2	2
TEST METER PCB			14PC	46S02272-0010	1	1	2	2
TACH DAMPING PCB			13PC	46S02273-0020	1	1	2	2
TIME DELAY PCB			10CR	46S02749-0010	1	1	2	2
RELAY 115V COIL			1,2,3 4,7CR	05P00036-0287	2	3	4	5
RELAY 24 V COIL			6CR	05P00205-0020	1	1	2	2
			5CR	05P00205-0012	1	1	2	2

* CMOS PCB. See paragraph 4.5 Special Handling of PCBs Which Contain MOS Devices.

** Direct replacement for 46S02264-0010.

Table 4.3 Spare Parts List (5 thru 200HP; 53SD-REV 2) - Continued

DESCRIPTION	SYMBOL	PART NUMBER	Recommended Stock Quantity Based on Number of Identical Drives or Assemblies			
			1-4	5-9	10-25	26 or More
POWER SUPPLY CABLE 2.75"	6CONN	44S00231-0002	0	0	0	0
PULSE TRANS, CABLE 6.00"	3CONN	44S00231-0003	0	0	0	0
PULSE TRANS, CABLE 6.00"	4CONN	44S00231-0004	0	0	0	0
PULSE TRANS, CABLE 10.00"	4CONN	44S00231-0005	0	0	0	0
RELAY/INTERFACE CABLE 8.50"	18CONN	44S00231-0006	0	0	0	0
RELAY/INTERFACE CABLE 10.00"	19CONN	44S00231-0007	0	0	0	0
VOLT/CURRENT FOLL. CABLE 2.75"	9CONN	44S00231-0015	0	0	0	0
TEST METER CABLE 2.75"	14CONN	44S00231-0008	0	0	0	0
PRECISION REF. CABLE 3.00"	8CONN	44S00231-0009	0	0	0	0
S-CURVE CABLE 2.00"	10CONN	44S00231-0010	0	0	0	0
TACH DAMPING CABLE 2.00"	11CONN	44S00231-0011	0	0	0	0
SPEED REG. CABLE 2.00"	7CONN	44S00231-0016	0	0	0	0
CONTROL STOP CABLE 2.00"	21CONN	44S00231-0012	0	0	0	0
AUTO/MANUAL CABLE 2.00"	22CONN	44S00231-0013	0	0	0	0
THREAD CABLE 2.00"	23CONN	44S00231-0014	0	0	0	0
HOLD DOWN CLIP 14 PIN		05P00001-0126	0	0	0	0
HOLD DOWN CLIP 16 PIN		05P00001-0155	0	0	0	0
HOLD DOWN CLIP 24 PIN		05P00001-0156	0	0	0	0
JUMPER PLUG	7CONN	46S02307-0010	0	0	0	0
JUMPER PLUG	8CONN	46S02064-0160	0	0	0	0
JUMPER PLUG	10CONN	46S02064-0170	0	0	0	0
TERMINAL BLOCK	1-2TB	46S02310-0010	0	0	0	0
KEY PIN FOR TERMINAL BLOCK	1-2TB	05P00060-0212	0	0	0	0

Table 4.3A Spare Part List (5 thru 200HP; 53SD-REV 2)
Panel Fuse Rating

DRIVE RATING		FUSE (4F) RATING	
230V	460V	NON-REVERSING	REVERSING
5HP, 7.5HP	7.5HP thru 15HP	2A	2A
10HP thru 75HP	20HP thru 150HP	2A	2A
N/A	200HP	6A	N/A

4.5 SPECIAL HANDLING OF PCBS WHICH CONTAIN MOS DEVICES

WARNING

SPECIAL HANDLING REQUIRED

MOS TYPE DEVICES CAN BE EASILY DAMAGED BY STATIC ELECTRICITY.

IF INSPECTION IS REQUIRED, READ THE REMOVAL AND INSTALLATION INSTRUCTIONS BEFORE REMOVING PRINTED CIRCUIT BOARDS.

4.5.1 Removal Of PCB From Cardrack

1. Ensure that no power is present at cardrack.

2. Touch cardrack with one hand and then remove PCB from cardrack with the other.

3. Attach contact shunt. Do not allow PCB to touch any surface while completing this step.

4. Inspect PCB WITHOUT PLACING ON A SURFACE OR REMOVING CONTACT SHUNT.

CAUTION

DO NOT PLACE PCB ON ANY SURFACE EXCEPT A TABLE OR BENCH WITH A VELOSTAT SHEET ON TOP WHICH IS CONNECTED THROUGH A 500K OHM RESISTOR TO GROUND. THE INDIVIDUAL WORKING AT THIS STATION MUST WEAR A CONDUCTIVE WRIST STRAP WHICH IS TIED TO THE VELOSTAT SHEET.

5. After inspection, install PCB into cardrack as follows.

4.5.2 Installation Of PCB Into Cardrack

1. Ensure that no power is present in cardrack connector.

2. Remove contact shunt from PCB. Do not allow PCB to touch any surface.

3. Touch cardrack with free hand and then insert PCB into cardrack.

4. Place contact shunt into black velostat bag and set aside for possible future use.

Table 4.4 Spare Parts List (200 thru 1000HP; 53SK)

Consult MagneTek for Assistance

SECTION 5. TROUBLESHOOTING

5.1 SAFETY CONSIDERATIONS

WARNING

THE ABOVE-GROUND ELECTRICAL POTENTIALS OF LOUIS ALLIS EQUIPMENT CAN BE HAZARDOUS. THEREFORE, IT IS STRONGLY RECOMMENDED THAT ALL ELECTRICAL WORK CONFORMS TO NATIONAL ELECTRICAL CODES AND LOCAL REGULATIONS. INSTALLATION, ALIGNMENT AND MAINTENANCE SHOULD BE PERFORMED ONLY BY QUALIFIED PERSONNEL ..... PREFERABLY FACTORY TRAINED. ONLY TEST PROCEDURES INCLUDED IN THIS INSTRUCTION MANUAL SHOULD BE FOLLOWED. ELECTRICAL POWER SHOULD ALWAYS BE DISCONNECTED BEFORE WORKING ON THE CONTROLLER. WHEN TESTING OR TROUBLE-SHOOTING USE ONLY GROUNDED CHASSIS, FLOATING COMMON TYPE TEST EQUIPMENT.

WARNING

ALWAYS REMOVE AC INPUT POWER WHEN CHECKING AND REPLACING POWER SECTION COMPONENTS (SCR'S, TRANSFORMERS, FUSES, ETC.) AND WHEN REPLACING RELAYS AND PRINTED CIRCUIT BOARDS.

NOTE

An understanding of the drive system is of great value in maintaining and servicing the equipment. It is remoc-mended, therefore, that the informa-tion given in the preceding parts of this manual be understood.

NOTE

Before troubleshooting the controller, be sure that the DC motor is not defective and that load conditions do not exceed controller and motor capabilities. After this has been done, check that all mechanical connections are tight, that there are no loose relays and fuses, and that all contactors operate freely.

5.1.1 Recommended Oscilloscope Proce dure

When using an oscilloscope to observe the high voltage waveforms in the Controller, the two oscilloscope chan-nels should be used in a differential mode with two x100 probes and with the oscilloscope chassis connected to earth ground.

WARNING

IF THE DIFFERENTIAL MODE IS NOT USED, THE OSCILLOSCOPE CHASSIS MUST NOT BE GROUNDED NOR CONNECTED WITH ANY OTHER CIRCUIT. IN THIS MODE, THE OSCILLOSCOPE CHASSIS AND ANY OBJECT TOUCHING THAT CHASSIS MAY BE AT A LETHAL ELECTRICAL POTENTIAL. OPERATION OF AN OSCILLOSCOPE IN THIS MANNER IS EXTREMELY HAZARDOUS AND IS SPECIFICALLY NOT RECOMMENDED.

5.2 USING THE TEST METER

When the Test Meter modification kit is installed in the Controller, many voltage measurements for troubleshooting can be made on the Test Meter without having to locate test points on the Volt/Speed Main PCB. Table 5.1 lists the measurements made by the Test Meter, and the corresponding test points on the Volt/Speed Main PCB.

5.3 SPECIAL HANDLING OF PCBS WHICH CONTAIN MOS DEVICES

WARNING - SPECIAL HANDLING REQUIRED

MOS TYPE DEVICES CAN BE EASILY DAMAGED BY STATIC ELECTRICITY.

IF INSPECTION IS REQUIRED, READ THE REMOVAL AND INSTALLATION INSTRUCTIONS BEFORE REMOVING PRINTED CIRCUIT BOARDS.

5.3.1 Removal of PCB From Cardrack

1. Ensure that no power is present at cardrack.

2. Touch cardrack with one hand and then remove PCB from cardrack with the other.

3. Attach contact shunt. Do not allow PCB to touch any surface while completing this step.

4. Inspect PCB WITHOUT PLACING ON A SURFACE OR REMOVING CONTACT SHUNT

CAUTION

DO NOT PLACE PCB ON ANY SURFACE EXCEPT A TABLE OR BENCH WITH A VELOSTAT SHEET ON TOP WHICH IS CONNECTED THROUGH A 500K OHM RESISTOR TO GROUND. THE INDIVIDUAL WORKING AT THIS STATION MUST WEAR A CONDUCTIVE WRIST STRAP WHICH IS TIED TO THE VELOSTAT SHEET.

5. After inspection, install PCB into cardrack as follows.

5.3.2 Installation of PCB Into Cardrack

1. Ensure that no power is present in cardrack connector.

2. Remove contact shunt from PCB. Do not allow PCB to touch any surface.

3. Touch cardrack with free hand and then insert PCB into cardrack.

4. Place contact shunt into black velostat bag and set aside for possible future use.

5.4 USING THE TROUBLESHOOTING FLOWCHART

Troubleshooting consists of a logical series of operational checks and observations designed to localize a fault to a printed circuit board or major circuit area.

Test equipment required for this method is a multimeter or the optional Test Meter modification. An oscilloscope may also be used.

Faults of the drive system are manifested in terms of different symptoms. The troubleshooting flowchart contains information for identifying the probable cause and performing the corrective action for each of the system faults.

SYMPTOM	FLOWCHART ENTRY POINT
Ready light and low line light Off	A
Ready light OFF, low line light ON	B
Ready light OFF, low line light OFF, IST light ON	C
Ready light OFF, low line light OFF, IST light OFF, overload light ON	D
Motor contactor 1M does not energize	E
Motor does not rotate	F
Motor rotation is too fast, too slow, or erratic	G
Field Loss light ON (located on Field Loss PCB) (200-1000HP) ...	H
Ripple Trip light ON (located on Front Panel) (400-1000HP)	I

Follow the procedure steps in the flowchart corresponding to the fault symptom observed. After applying a Corrective Action, observe the system in operation. If the symptom no longer exists, you have cleared the fault. If the symptom still exists, replace the new component with the original, and return to Step 1 of the portion of the flowchart for the fault symptom.

Test point voltages and waveforms referred to in the flowchart are listed in Table 5.2.

If the Controller CANNOT BE SUCCESSFULLY REPAIRED, CONTACT THE NEAREST LOUIS ALLIS DISTRICT OFFICE FOR FIELD SERVICE ASSISTANCE.

Table 5.1 Test Meter Measurements

TEST METER SELECTOR SWITCH 1SS POSITION	VOLTAGE/SIGNAL MEASURED	EQUIVALENT TP ON VOLT/SPEED MAIN PCB *
0	+10V OUTPUT OF POWER SUPPLY PCB	32TP
1	-10V OUTPUT OF POWER SUPPLY PCB	34TP
2	+15V ±0.75V OUTPUT OF POWER SUPPLY PCB	31TP
3	-15V ±0.75V OUTPUT OF POWER SUPPLY PCB	35TP
4	0 TO -10V LAC INPUT	36TP
5	0 TO -10V VOLT/SPEED REFERENCE	30TP
6	0 to +5V VOLT/SPEED FEEDBACK	40TP
7	--- NO CONNECTION ---	--
8	0 TO +1V CURRENT FEEDBACK	10TP
9	0 TO -5V CURRENT REFERENCE	8TP
10	+24V ±5V OUTPUT OF POWER SUPPLY PCB	37TP
11	-24V ±5V OUTPUT OF POWER SUPPLY PCB	38TP
12	0 TO 600V DC OUTPUT	9TP
13	0 TO 500V AVERAGE RMS AC LINE VOLTS	25TP
14 **	0 TO ±50V PEAK MAXIMUM GENERAL TEST POINT	39TP **
15	0 TO -5V CURRENT LIMIT (-3.75V FOR 150% CURRENT LIMIT)	14TP

* Refer to Figure 5.1 for Test point locations. All measurements are reference to 33TP (common).

** Other test points on the Volt/Speed Main PCB (see Figure 5.1 and Table 5.2) can be measured on the Test Meter by using the Universal Test Point. Jumper the desired test point to 39TP, set the Test Meter to position 14, and observe the LED readout.

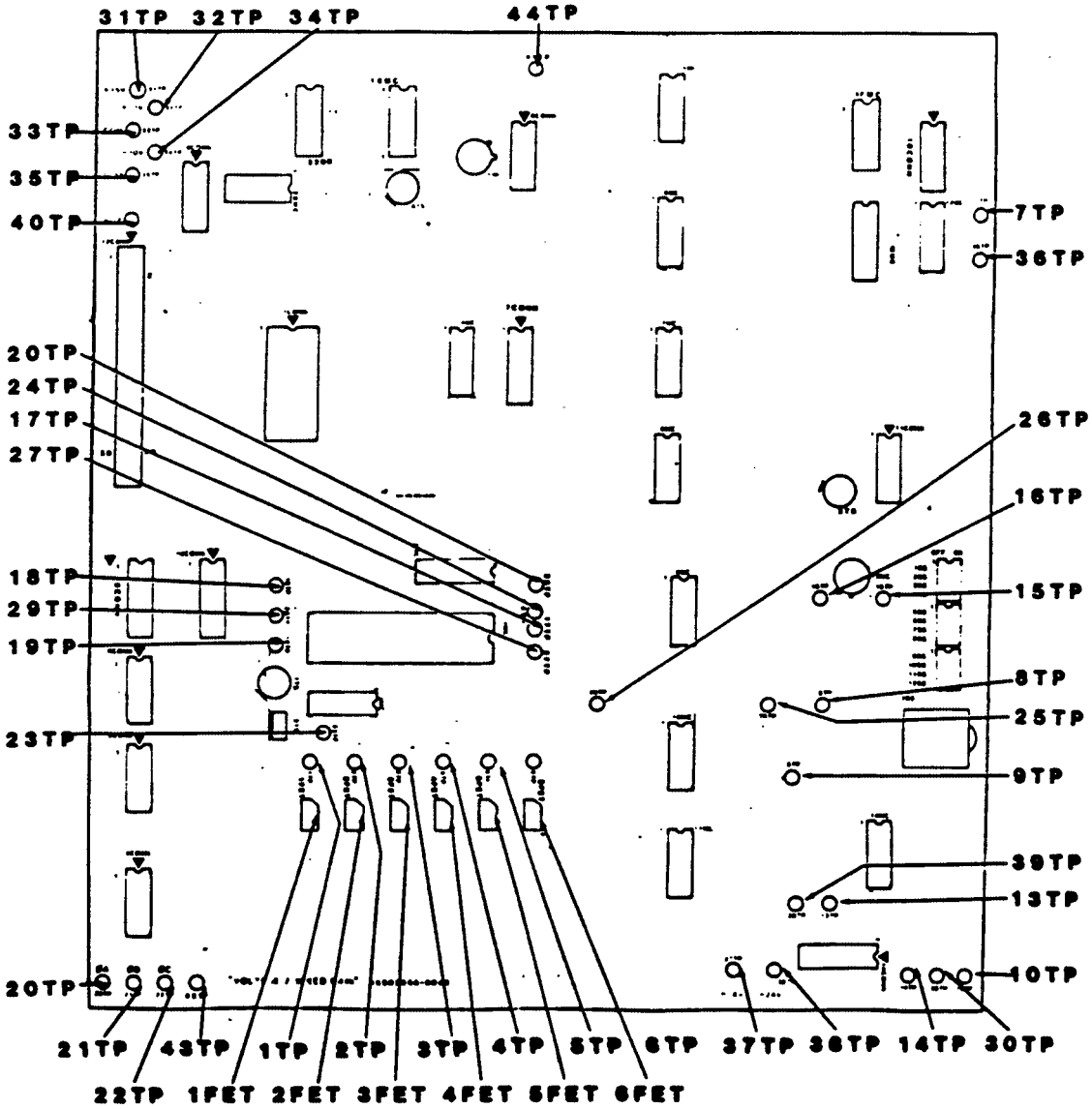


Figure 5.1 Voltage/Speed Main PCB (Simplified)
Test Point Location

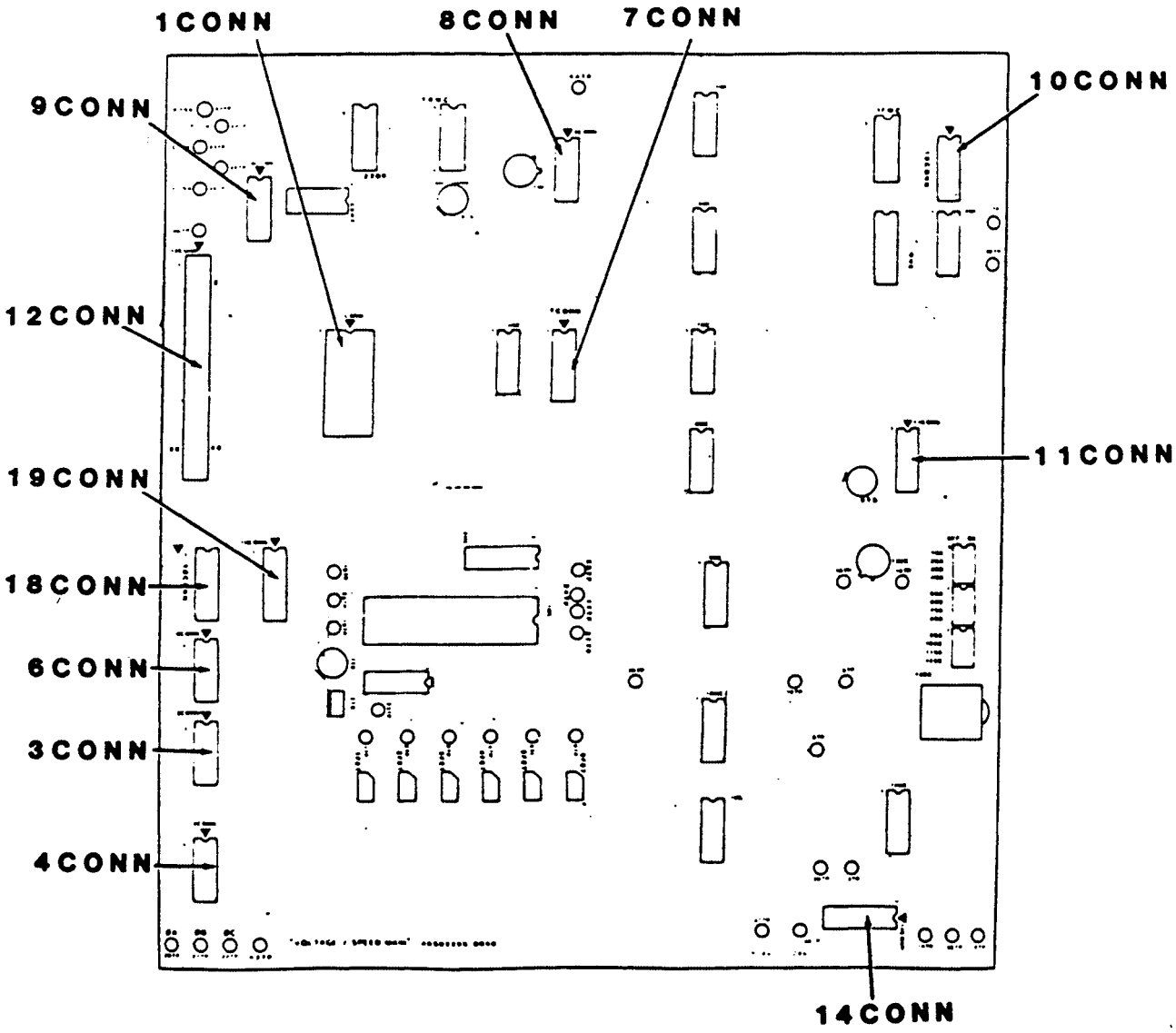


Figure 5.2 Voltage/Speed Main PCB (Simplified)
Connector Location

Table 5.2 Test Point Voltages and Waveforms

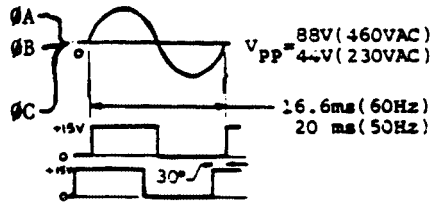
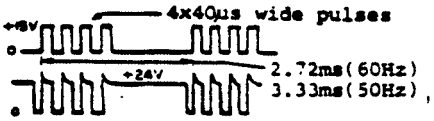
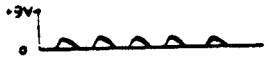
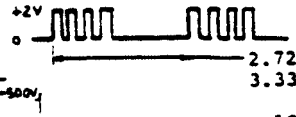
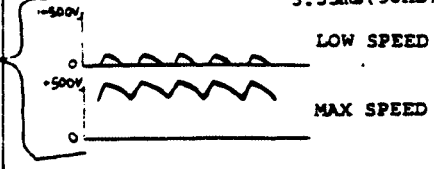
TERMINAL OR TEST POINT*	LOCATION	MEASURED VALUE	NOTES
1TP-19 to 1TB-15	RELAY/INTERFACE	115V ±10%	115VAC RELAY POWER
37TP	VOLT/SPEED MAIN	+24VDC ±5V 1.3vpp ripple	OUTPUTS OF POWER SUPPLY PCB AND PRECISION REFERENCE CIRCUIT
31TP	" " "	+15VDC ±0.75	
32TP	" " "	+10VDC ±0.1V 10mvpp ripple	
34TP	" " "	-10VDC ±0.1V	
35TP	" " "	-15VDC ±0.75V	
38TP	" " "	-24VDC ±5V 1.3vpp ripple	
1TB-14 to 1TB-15	RELAY/INTERFACE	115VAC ±10%	WHEN RUN PB IS PRESSED
1TB-12 to 1TB-15	" " "	" "	WHEN JOG PB IS PRESSED
1TB-13 to 1TB-15	" " "	" "	WHEN RUN OR JOG PB IS PRESSED
1TB-21 to 1TB-15	" " "	" "	WHEN MAIN CONTACTOR HAS ENERGIZED
43TP	VOLT/SPEED MAIN	+15VDC	WHEN AUX ON MAIN CONTACTOR HAS CLOSED
29TP	" " "	+15VDC	" " " "
20TP	" " "		WHEN POWER IS APPLIED
21TP	" " "		" " "
22TP	" " "		" " "
24TP	" " "		" " "
23TP	" " "		" " "
26TP	" " "	VDC FOR 460VAC VDC FOR 230VAC	" " " " " "
27TP	" " "		" " "
1,2,3,4,5,6TP	" " "		" " "
1,2,3,4,5,6FET TABS	" " "		" " " " " "
36TP	" " "	0 TO -10VDC	WHEN SPEED POT IS VARIED
7TP	" " "	0 TO -10VDC	" " "
30TP	" " "	0 TO -10VDC	" " "
9TP	" " "	0 TO +9VDC	" " "
40TP	" " "	0 TO +5VDC	" " "
8TP	" " "	0 TO -5VDC	WHEN LOAD ON MOTOR IS VARIED
13TP	" " "	0 TO -7.5VDC	" " "
14TP	" " "	0 TO -5VDC (200% CURRENT LIMIT)	FUNCTION OF CURRENT LIMIT POT SETTING

Table 5.2 Test Point Voltages and Waveforms - continued

TERMINAL OR TEST POINT*	LOCATION	MEASURED VALUE	NOTES
15TP	" " "	-10V TO +10VDC	FUNCTION OF LOAD AND SPEED
16TP	" " "	+2.4V to -10VDC	
17TP	" " "	 pulse train with variable widths	
18TP	" " "	0 TO +1VDC	
19TP	" " "	 LOW SPEED	
		 MAX SPEED	
GATE TO CATHODE	ON THYRISTORS 1-6SCR	 2.72ms(60Hz) 3.33ms(50Hz)	WHEN POWER IS APPLIED
DC OUTPUT	+ AND - OF POWER BRIDGE	 LOW SPEED MAX SPEED	FUNCTION OF LOAD AND SPEED LOOK FOR MISSING PULSES

* ALL TEST POINTS ARE REFERENCE TO 33TP (COMMON).

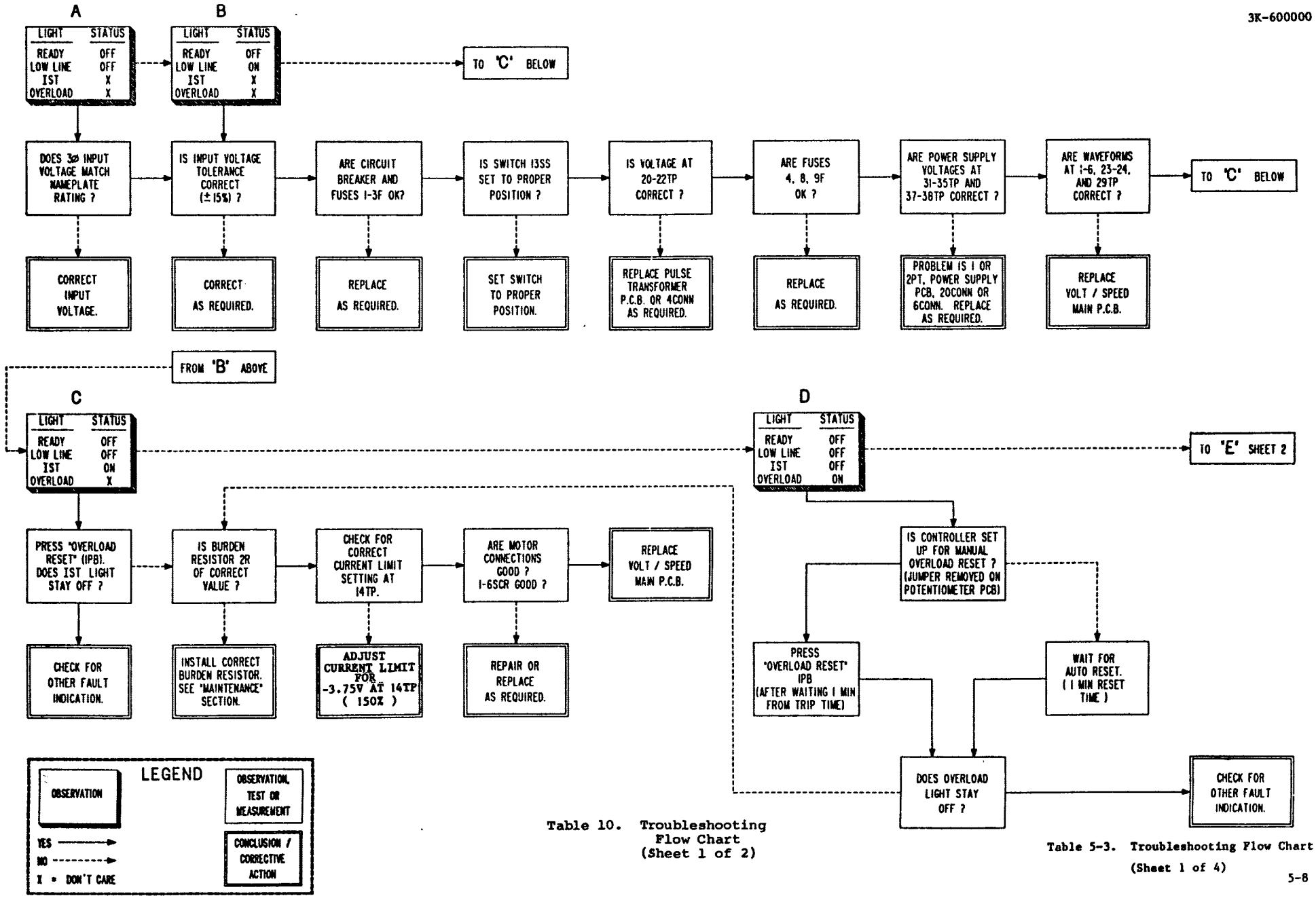


Table 10. Troubleshooting Flow Chart (Sheet 1 of 2)

Table 5-3. Troubleshooting Flow Chart (Sheet 1 of 4)

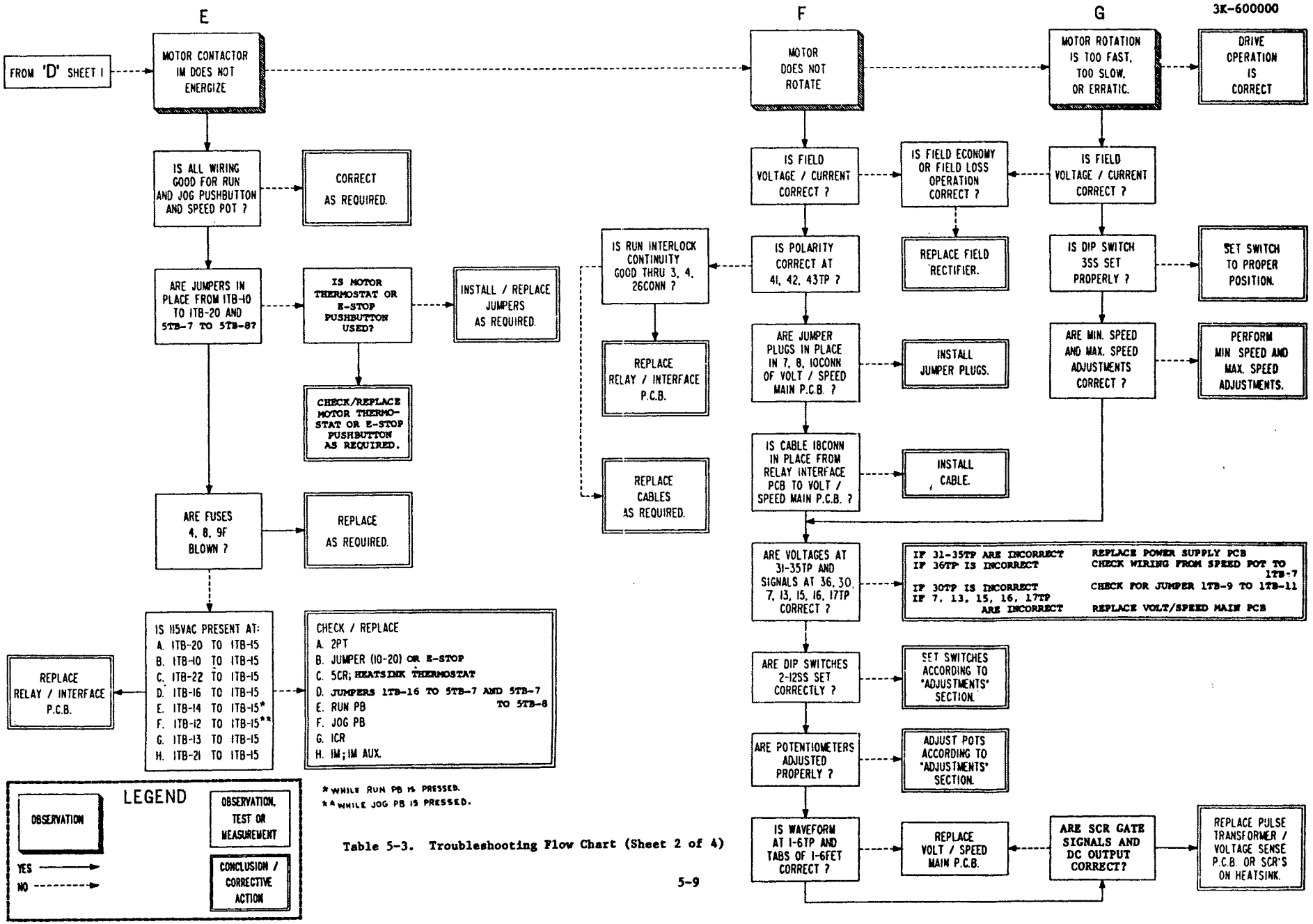


Table 5-3. Troubleshooting Flow Chart (Sheet 2 of 4)

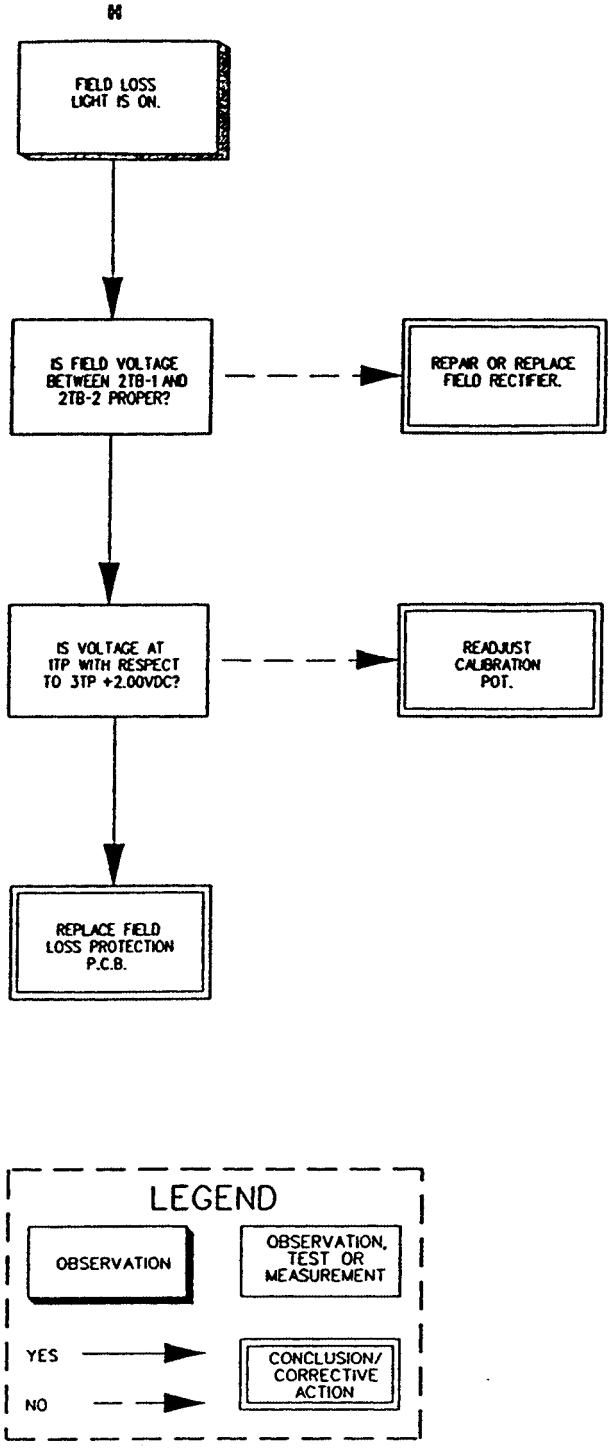


Table 5-3. Troubleshooting Flow Chart (Sheet 3 of 4)

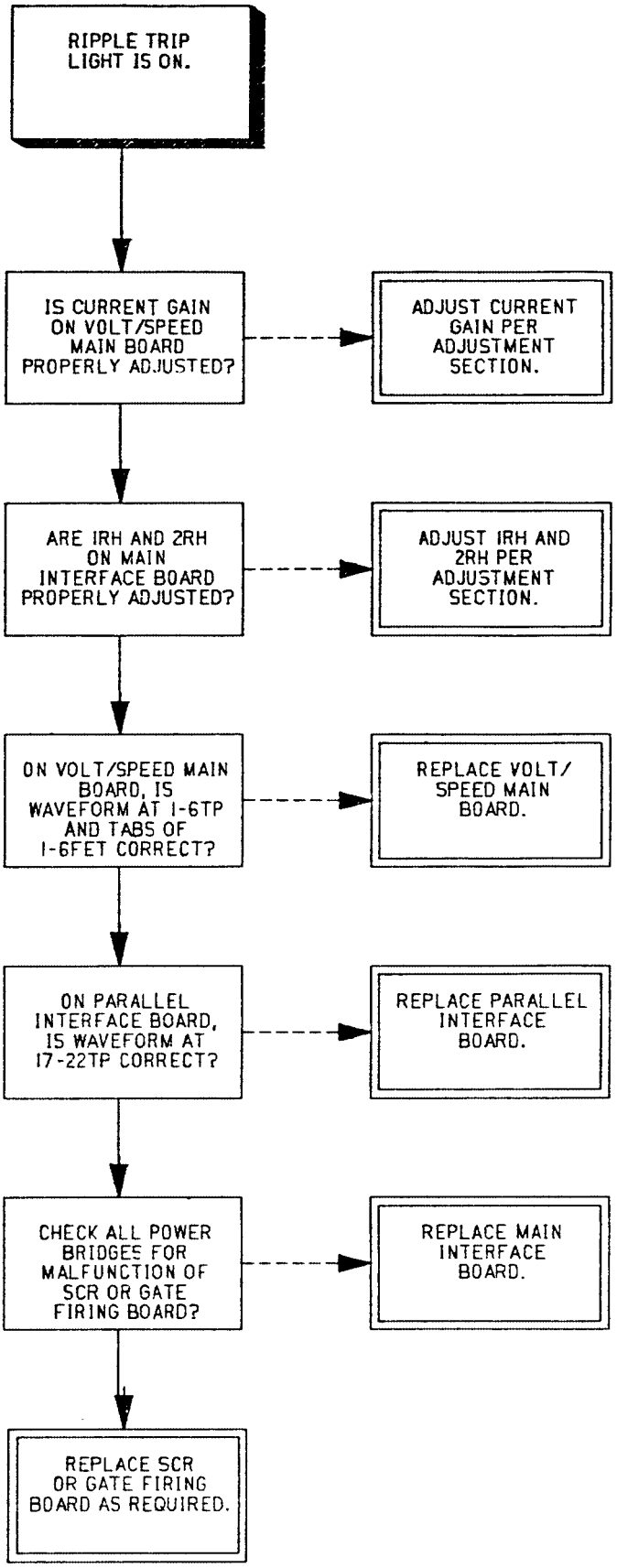


Table 5-3. Troubleshooting Flow Chart (Sheet 4 of 4)

SECTION 6. SCHEMATIC MODIFICATION

6.1 SCHEMATIC MODIFICATION

Each Modification Kit contains one or more schematic overlays to be applied to the basic schematic diagram. Apply the overlays as follows:

A. Locate the proper position for installing each overlay to the basic schematic diagram.

To determine proper position, refer to the 45T number at the BOTTOM of the overlay. THE LAST TWO CHARACTERS identify the schematic sheet number and which modification area the overlay is to be placed in.

EXAMPLE: 45T00208-0211 3 E

SHEET NUMBER
MOD AREA ON SHEET 3

B. Carefully peel paper backing from the left edge of the schematic overlay and fold back about 3/8 inch of the backing.

C. Align the schematic overlay with interconnecting wires using the corner marks on the schematic diagram as a guide.

D. Press the left edge of the schematic overlay onto the schematic diagram.

E. Peel off the remaining paper backing and at the same time press the overlay into position. DO NOT attempt to lift the overlay after it has been pressed into position.

NOTE

In case of loss or damage, additional schematic diagrams and overlays can be obtained through your nearest MagneTek representative.

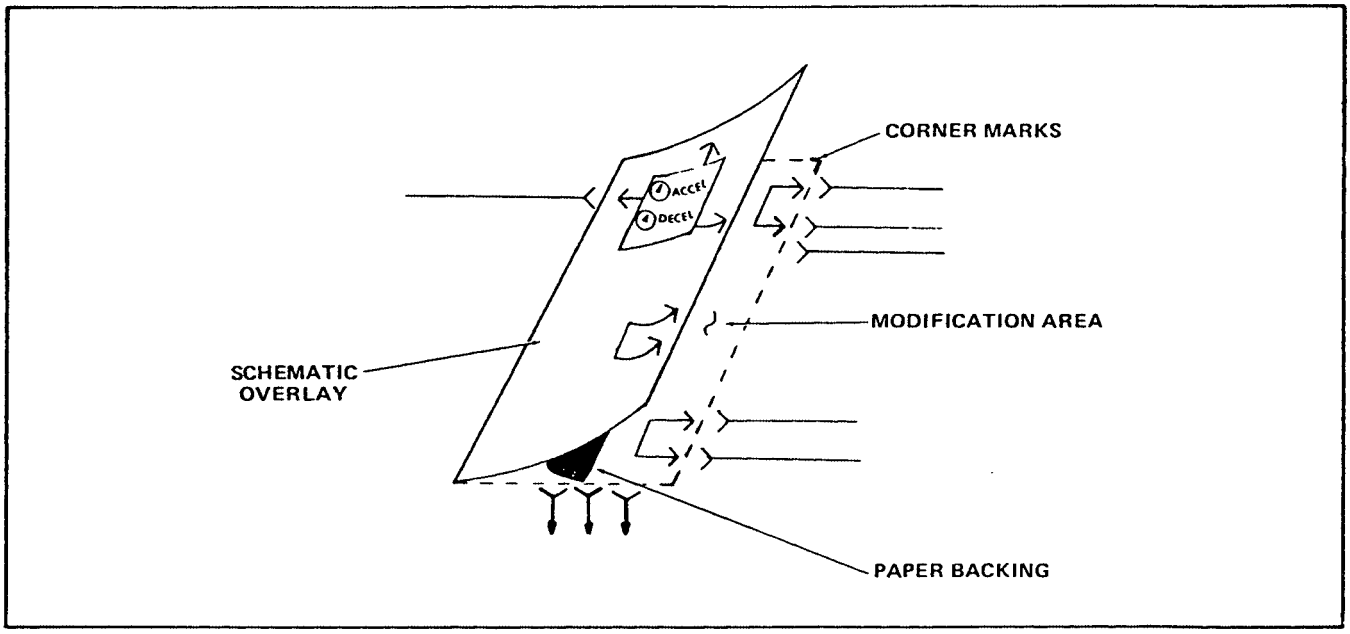


Figure 6-1 Application of Schematic Overlay

DRAWINGS

The following sheets provide pictorial and wire list interconnection information for basic 2 HP thru 200 HP Saber 3306 Controllers.